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OBSERVATIONS ON THE CLINICAL VALUE OF THE ROENTGEN RAY IN THE DIAGNOSIS OF CARDIOVASCULAR DISEASE*

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THIS Thirtieth Annual Meeting of the American Roentgen Ray Society is evidence of the progress in medical science that has taken place in our generation and I am grateful for the opportunity to have a part in the cardiac symposium. I am a clinician and my message to you will summarize some experiences of mine in the application of roentgen studies to the diagnosis and treatment of cardiovascular disease in the past few years. I have been doubly fortunate, first, in living and working during the evolution of this method of study, and second, in having as my teachers and associates Dr. George W. Holmes and his colleagues, past and present, many of whom are here today and some of whom are taking part in the present symposium, and Dr. Hugo Rösler of Vienna with whom I studied last winter. My observation of the clinical application of roentgen rays began with general hospital patients but it has been only in the past nine years since I started private practice and I have more fully appreciated the status of cardiovascular roentgenology. Although most of my remarks will deal with the limitations of this method of study, my appreciation of its value is illustrated by the fact that I am about to install for my personal use an apparatus for orthodiagraphic study. Up to now I have used the experience and apparatus of Dr. Holmes and others and I want to continue to be allowed to do so but in addition I believe the method of examination to be so important that I wish to have it for immediate use and for investigation myself.

I shall now present seven observations for your consideration and criticism.

In the first place, roentgenology is but one of several clinical methods of studying the circulation. Like the others it is incomplete in itself and it ranks down the list in value. We must not expect too much from it. A careful history is most important of all in the diagnosis of cardiovascular disease, and physical examination comes next in usefulness. Accessory and occasionally valuable methods of study are sphygmomanometry, roentgenology and electrocardiography. For the complete examination of a patient with cardiovascular symptoms or signs all these procedures should be included; often they will add no new or important facts but sometimes they will present information of value that cannot be discovered by other means and may be quite unexpected; even so-called negative findings are worth while having on

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record. It is wise to include routinely a roentgen examination in the analysis of every cardiovascular patient but it is essential that it be made accurately and interpreted intelligently by an experienced person. Sometimes errors in technique and interpretation render the procedure a serious handicap in diagnosis rather than a help and in a considerable percentage of cases examined routinely throughout the countryside at the present time it would for this very reason be more helpful to omit roentgen-ray study than to include it. This fact is true of all other methods of examination and is by no means limited to the roentgenological procedure. A poor history may lead one far astray, as also may the inaccurate timing of heart murmurs, or artefacts and misinterpretation in electrocardiography. After this statement of the relative value of cardiovascular roentgen examination, let us proceed to the discussion of some of the findings, which begin with the second important observation in this paper.

The roentgen rays provide a method for the demonstration of moderately or far advanced pathology only, even though such pathology is revealed in no other way. It is not a way to show early or slight disease except in rare instances and so, at the present time at least, it is of little or no value in the early discovery of trouble that can be stopped at its onset or retarded before permanent and incurable changes have set in. This is of course a serious limitation of the clinical value of the method as it is of many other methods, and is largely the reason why some able physicians like Sir James Mackenzie have minimized its use. Even greater refinements in methods of application and in interpretation now being developed are unlikely to help much in this particular. Thus in many respects positive roentgen findings are largely of academic interest alone like much positive evidence of serious heart disease found on physical examination in chronic cardiac patients on the hospital wards. However, even though disease may not often be amenable to therapeutic relief after it has advanced to the stage when it can be discovered by roentgen ray, exact knowledge of its extent and type is often invaluable in prognosis and in the proper handling of chronic disease where life may be prolonged and made more comfortable, useful and happy by intelligent treatment.

My third observation is brief but important. Serious and indeed fatal heart disease may be present with no indication of trouble on roentgen examination, or even by any other method of study except perhaps by history. This is particularly true of angina pectoris which is now generally recognized to be dependent primarily on coronary disease. The size and shape of heart and great vessels are frequently entirely normal in angina pectoris which yet may result in sudden death, and without a history this serious condition is not diagnosable. Of about 500 cases of angina pectoris that I have seen in private practice in the past nine years approximately 25 per cent showed no evidence of heart disease on examination, which included roentgen-ray study in many cases. Luetic aortitis also, before the aorta has become dilated or the aortic valve defective, may escape notice and yet result fatally, usually by narrowing of the coronary artery mouths.

In the fourth place, roentgenology is a crude method of study, even though at first glance it sometimes gives the impression of being a very delicate and accurate one. Normal variations in the size and shape of the shadow of the heart and aorta are so great that errors in the interpretation based on slight changes from the average normal are very frequent. This is true of any position in which the study is made, and it is this fact that has caused many authorities to discount measurements and figures to a very large extent. Slight changes in size and shape due to disease may not be distinguishable from similar slight changes due to normal variations.

This results about equally in the occasional diagnosis of organic disease when none is present and in the failure to recognize such disease when it is present. There are too many factors like age, height, build, shape of chest, and the height and excursion of the diaphragm to be taken into consideration to permit, at present, absolute reliance on any table of standard normal measurements. The more cases studied, the wider have become the limits of normal. For example where once 50 per cent was thought to be the upper limit of normal for the so-called cardiothoracic ratio, that is, the ratio of the total transverse diameter of the heart shadow to the internal diameter of the thorax in the anteroposterior orthodiagram or teleroentgenogram, now it is put at 57 per cent, depending on the position of the heart as well as on its size. As a matter of fact, for one individual a ratio of 52 per cent may be perfectly normal while that of 47 per cent in another case may be too large, being associated with actual hypertrophy. The same is true of other measurements like that of area of the cardiac shadow. It has even been estimated that it is possible in the anteroposterior view for the area measurement in a given area to increase 75 per cent from the lower limit of normal and still remain within the upper limit of normal. Thus well-marked variations from the so-called normal in size or shape must be encountered before definite conclusions as to the presence of cardiovascular pathology can be drawn. If in any given case it were possible to have for comparison roentgenray records accurately and similarly obtained before and after the onset of disease we would be far better off than we are now in attempting to fit a case into standard tables. However, in spite of all these difficulties it is useful and practically essential to have normal standard measurements for comparison and if we realize the limitations of the method we can use such measurements to advantage. There is a feeling abroad, as I found in Vienna, that we in America make too much of figures and try to devise too many formulas wherein to fit the data obtained in clinical studies, and this criticism is doubtless to a certain extent just. We must not lull ourselves into a false sense of accuracy by elaborate tables, formulas and figures, and this is as true in roentgenology as in other methods of examination. It is best to hold the middle course and neither overrate nor underrate the value of actual measurements.

My fifth point concerns accuracy of technique. A method which is inherently accurate may become a source of confusion when errors creep in as they are so frequently likely to do in cardiovascular roentgenology even in the best of hands. We must be on our guard every minute. There may be much distortion with enlargement of the heart shadow when a roentgenogram is taken with the tube too near the chest and the chest itself not flat against the film or plate. It is wrong to attempt to estimate with any degree of accuracy the size of the heart and great vessels from such a record unless one has had great experience in this particular technique and the distances of tube to heart and heart to film are always constant, which is impossible in dealing with chests of different size and shape. Even with orthodiagram or teleroentgenogram (the so-called "seven foot film") it is essential that there be no rotation of the chest in the anteroposterior view or important deviation from a set position in the oblique views, for otherwise measurements and the shape of the shadow borders may be misleading. It is frequent for rotation in the anteroposterior view to cause an error of a centimeter or more in the distance of left or of right border of the heart shadow from the midline. In my experience the commonest error has been due to a slight rotation to the left so that the right border is reported too near the midline and the left border too far from it, by perhaps a centimeter in each case, the total trans-

verse diameter remaining fairly accurate, however. Rotation or an unusually low position of the diaphragm due to a long chest in a tall person or to other cause, may give unusual prominence to the left upper border of the heart shadow giving rise to an impression that the heart has a so-called "mitral shape" or a prominent pulmonic artery which may suggest patency of the ductus arteriosus. Simple errors of measurement or of copying measurements are common, or the "midline" may not be drawn in the middle. For reasons like these I have found that my physical examination (palpation and percussion) has been routinely a valuable check on the accuracy of roentgenograms as well as an important method of examination of heart size and shape in many cases when roentgen rays are not available. My percussion and palpation have yielded data more accurate than that reported to me by various roentgenologists so often, as proved by carefully repeated studies, that I should never think of abandoning these cruder methods of study simply because roentgen examination is fundamentally more accurate. By practice one's proficiency in cardiac examination by palpation and percussion increases as it does in other study, and if one abandons such practice of course he must rely on roentgenology alone with little control of its errors, and feel rather helpless when the roentgen rays are not available.

My sixth point is that the roentgenologist or internist using the roentgen rays should state what he sees in the way of structural change and not attempt to make an etiological diagnosis. It is better to say aortic dilatation and to give the measurements than to say luetic aortitis (for perhaps hypertension and not lues may be the cause of the dilatation (in the absence of frank aneurysms), and to state that the heart is enlarged with prominence of the left upper border and high apex (giving measurements), rather than to diagnose "rheumatic mitral disease." It is safer and wiser in the end not to diagnose too much from the roentgen examination.

Finally, the seventh observation concerns the actual method of examination. Roentgenoscopic study is probably most important of all and especially in various positions—one alone does not suffice. Of particular interest and value is observation of the pulsating heart and vessel shadow during the actual rotation from one position to another. This allows easier identification of all parts and also affords a more complete idea of the shape and size of each part than can be obtained from any single view, just as we can judge an object better by walking around it or by turning it around than by viewing it from two or three positions only.

In this paper I have not taken up the actual roentgen findings in chronic hypertension, mitral stenosis, pericardial effusion and other such lesions, since these are quite well known and fairly well described. It has seemed more worth while at present to discuss the place and the limitations of roentgenology in cardiovascular practice and I hope that my observations may have proved of some interest and value to you.*

Later Note: For the sake of completeness and because some of those who listened to this paper in New York have suggested that it might prove helpful to balance against the limitations of roentgen study in heart disease its special advantages, even though they are better known and recognized, I shall take the opportunity to add herewith some of my remarks made at a meeting of the New England Roentgen Ray Society in Boston on October 18, 1929. I summarized six particular points on which the usefulness of the roentgen ray in cardiovascular diagnosis is based, as follows:

In the first place, the roentgen ray affords by far the most accurate measurements of heart size and of heart shape that we possess in the clinic.

Second, in the presence of obesity, emphysema and other complications which

* For discussion see page 405.

render physical examination of the heart very imperfect, the roentgen ray affords sometimes the only means of determining heart size and shape.

Third, surprising and unexpected findings like pericardial calcification or aneurysms of the aorta are sometimes revealed by roentgen study alone, and in themselves justify a routine employment of this method of examination wherever possible.

Fourth, the size of the aorta and of the left auricle, and even sometimes of the left ventricle, can be determined only by the roentgen ray.

Fifth, abnormalities of the hilus shadows and of the pulmonary artery are important findings to be discovered only by the roentgen ray, and

Sixth, roentgen-ray observation of peculiarities of the actual pulsation of the heart and great vessels is alone worth the trouble of applying this method of study.

Finally, I should like to add that I was especially impressed at the New York meeting by the evidently justifiable emphasis there placed on the particular value of the left anterior-oblique view of the heart and great vessels in affording perhaps the best views of all the chambers and of the aorta and pulmonary artery.

THE UNCOILED AORTA

PART I. THE NORMAL AORTA*

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A PERUSAL of the roentgen literature of both continents concerning the normal and pathologic aorta will show that little unanimity of opinion exists. Under the existing conditions, both the clinician and investigator are left in a quandary. Therefore, a study which would tend to clarify the subject seemed justifiable.

REVIEW OF LITERATURE

That the right border of the supracardiac shadow in the frontal view is made by the ascending aorta is unequivocally stated by Martin,[17] Groedel,[8] and Longcope.[15] Chaperon,[3] on the other hand, maintains that it is always made by the superior vena cava. According to Vaquez and Bordet,[19] and Holmes,[10] the first part is formed by the superior vena cava while the aorta forms the remainder. Karshner and Kennicott[13] have taken a neutral stand—that sometimes it is formed by the superior vena cava and at others by the aorta. The Report of the National Tuberculosis Association[18] is noncommittal.

Similar differences of opinion exist in reference to the formation of the left border of the supracardiac shadow. Thus Holmes[10] states that four arcs exist on the left border of the central shadow, viz., aortic arch, pulmonary artery, left auricular appendage, and left ventricle, while Chaperon[3] maintains that there are but three arcs—the left auricular appendage being invisible.

The inadequacy of the frontal view in determining the aortic caliber, and the need for additional aid seems generally conceded. But again authors differ in opinion as to the particular kind. On the one hand, we have Vaquez and Bordet, Holmes, Chaumet[4] and Chaperon advocating the oblique views, while on the other, the Report of the National Tuberculosis Association states that the direct lateral is the better. Kreuzfuchs[14] claims that the esophageal-aortic arch relationship as determined with the aid of the barium meal is the ideal method. Weiss and Lauda[20] contend that this method is subject to many sources of error.

METHOD OF STUDY AND TECHNIQUE

It was apparent at the outset that a clear conception of the normal and pathologic aorta could only be obtained after the establishment of certain fundamental facts. Therefore, the following methods of investigation were pursued: (*a*) a study of the usual anatomic dissections including cross-sections and a stereoscopic atlas; (*b*) injection of opaque materials into the vessels of 8 cadavers; these patients at time of death ranged from thirty-three to sixty-eight years of age; (*c*) injection of air into the aorta under pressure in 4 cadavers; (*d*) a consideration of ordinary tube mechanics; (*e*) a correlation of these findings with roentgenograms of normal and pathologic subjects, including a consideration of histopathology.

In method (*b*), cannulas were introduced into both common carotid arteries and right internal jugular vein. The aorta was washed with tepid physiologic saline solution under slight pressure. The superior vena cava and aorta were then injected with an emulsion of barium and glycerine.† Roentgenograms were taken before and after individual injections in a postero-

† In one case 40 per cent sodium iodide was used, but this was found not to be of sufficient density.

* Read at the Thirtieth Annual Meeting, American Roentgen Ray Society, New York City, Sept. 17–20, 1929.

anterior direction from beneath the table. The thoracic cage was left intact. The method was essentially that used by Chaperon.[2]

In method (*c*) the left carotid cannula was attached to a mercury manometer and the right injected by means of the clinical blood pressure bulb.

The roentgenograms of patients were made as follows: (1) direct posteroanterior position, 4 foot target plate distance with retention of breath after a moderately deep inspiration, 3/20 second exposure; (2) direct posteroanterior, 7 foot target plate distance, during quiet respiration, 6 to 10 seconds' exposure; (3) right anterior-oblique, 45° (Vaquez and Bordet), 3 foot target plate distance with retention of breath in inspiration, 1/5 second exposure; (4) left anterior-oblique, 25° angle (arbitrary and will be described later), 1/5 second exposure with retention of breath in inspiration, 3 foot target plate distance. The patient maintained the upright standing position, with few exceptions. A simple goniometer was used. It consisted of two narrow wooden rods hinged at one end. The angle was obtained by applying it to a chart. The goniometer was applied between the plate changer and the anterior chest wall about the level of the mid-sternal region. Thirty-four normal subjects were examined in this manner. At the same time observations were made on a large number of aortas during the routine roentgenoscopic gastrointestinal examinations over a period of six months. The pathologic material (to be described in Part II*) was carefully selected and for convenience only the four major groups were tabulated, viz., syphilitic disease, 10 cases; hypertensive heart disease, 15 cases; arteriosclerosis, 12 cases; rheumatic heart disease, 7 cases.

DISCUSSION

Gross Anatomy. Gray's Anatomy[7] describes the aorta as follows: "It will be remembered that the ascending aorta is contained in the pericardium just behind the sternum being crossed at the commencement by the pulmonary artery, and right auricular appendix and having the right pulmonary artery behind, the superior vena cava on the right side, and the pulmonary artery and left auricle on the left side." Cross sections[6] show the superior vena cava contiguous and slightly posterior to the base of the aorta. A stereoscopic anatomic study[5] confirms these observations. But these findings are subject to the justifiable criticism of Groedel.[8]

ROENTGEN STUDY OF INJECTED VESSELS

In the injected cadavers the thoracic cage was left intact and the intrathoracic pressure maintained. These were made from 8½ to 32½ hours post mortem, thus insuring the characteristics of an aorta free from rigor mortis.

Fig. 1. Injection of barium emulsion into the superior vena cava and into the aorta. This was done about twelve hours post mortem in a patient sixty-two years old. The thoracic cage was left intact. Note that the right border of the ascending aorta in its central part slightly overlaps the superior vena cava, otherwise a potential space exists between them.

* Part II will be published in a later issue.

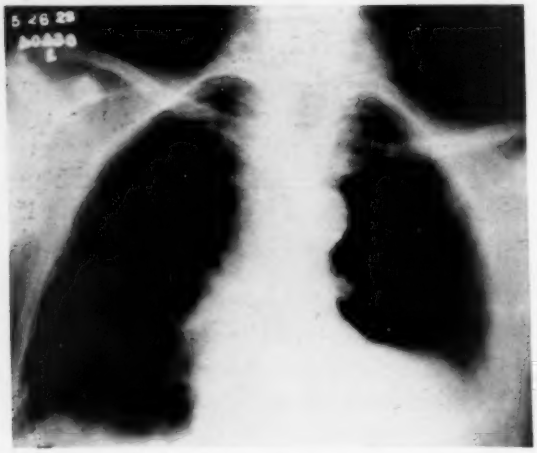

Fig. 2*a*. Ante-mortem roentgenogram (posteroanterior projection) of a patient sixty-eight years of age, whose vessels were injected post mortem. These are shown in the following figures.

Referring to Figures 1 and 5*d*, the relation between the ascending aorta and the superior vena cava should be noted. The latter is distinctly to the right of the former and a space exists between them. The right innominate vein extends upward and to the right. As senility is approached the right border of the aorta tends to extend farther to the right of the mid-line (see Figs. 2*c*, 2*d*, and 2*e*).

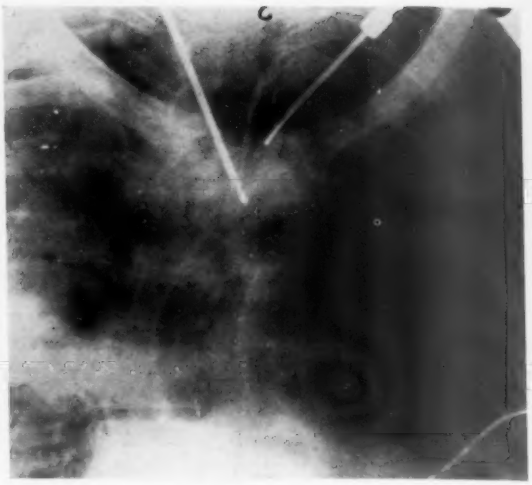

Fig. 2*c*. Distention of the aorta by air injection through a cannula inserted into the right common carotid artery. The pressure was 80 mm. Hg as registered by a manometer connected to a cannula inserted into the left common carotid artery.

Still the objection could rightfully be raised that at post mortem the aorta is contracted and does not represent the

Fig. 2*b*. Roentgenogram (posteroanterior projection) made 32½ hours post mortem.

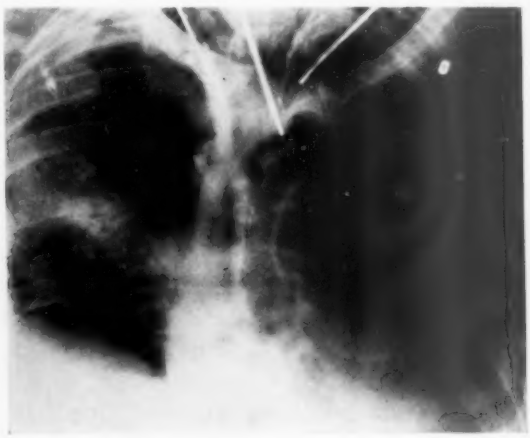

Fig. 2*d*. Air-distended aorta contrasted with the superior vena cava filled with barium emulsion. Note that as the aorta becomes distended its right border overrides the superior vena cava and tends to approximate the right margin of the latter. It does not displace the vena cava to the right. The right margin of the superior vena cava is slightly convex.

Fig. 2*e*. Aorta injected with barium emulsion following the procedure described in Figure 2*d*. Note the difference in caliber between the air-distended aorta (Fig. 2*d*) and the one filled with barium without pressure. The latter demonstrates the caliber of a post-mortem contracted aorta.

Fig. 2*f*. An attempt was made to illustrate the effect of the diaphragmatic level on the aorta by displacing the heart upward manually after making an incision through the diaphragm. This is an exaggerated illustration of the type of aorta observed in a hypersthenic individual.

conditions during life when the aorta is under pressure, normally about 150 mm. Hg (Howell[11]). It was then decided to approximate this condition by subjecting the aorta to the stressing force of air injections. That arteries retain viable characteristics after death was demonstrated by McWilliam and Mackie,[16] and Hwiliwitzkaja.[12]

It will be noted (Figs. 2*c*, 2*d* and 2*e*) that as the aorta becomes distended its right border overrides the superior vena cava and tends to approximate the right margin of the latter. It does not displace the vena cava to the right. The right margin of the vena cava is slightly convex. This fact accounts for the mistaken conception of the supracardiac shadow during life. It was argued by Groedel that the curve of the arch was continuous with that ascending from the right auricle. Hence, the right margin of the supracardiac shadow must be the aorta. As the aorta elongates and ascends towards the left sternoclavicular joint, it evidently makes traction on the tissue between it and the superior vena

Fig. 2*g*. Illustrating the opposite effect from that described in Figure 2*f* by pulling the heart downward. This is the type of aorta observed in the hyposthenic individual.

Fig. 2*h*. Left anterior-oblique position (Chaperon) about 25° angle, demonstrating the aortic uncoiling. Note the arch of the aorta with its separated limbs. Also note the position of the right border of the ascending aorta and the left border of the descending aorta.

cava, thus displacing the latter in a parallel direction.

Due to the fact that air escaped through the cut small vessels in the neck and about

Fig. 2*i*. Right anterior-oblique position (Vaquez and Bordet) about 45° angle.

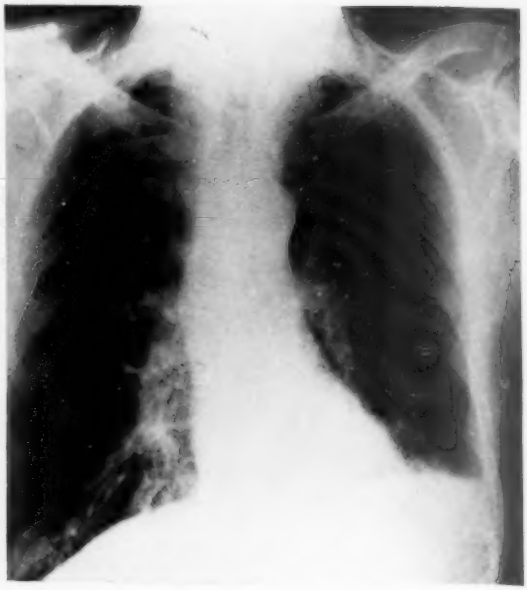

Fig. 3*a*. Roentgenogram of a patient sixty-two years old. Note the thin curved calcified plaques in the region of the left superior border of the arch and just within the right margin of the supracardiac shadow near the base.

the cannulas, the pressure in the aorta must have been greater than 80 mm. Hg. The question naturally arises whether the right border of the aorta would have surpassed the vena cava at 150 mm. Hg pressure. This is a difficult question to answer. Several methods of approach present themselves, such as experiments concerning elasticity and distensibility under varying pressures on the post-mortem aorta before rigor mortis has taken place; then the determination on animals of the difference in caliber before and after death (should the opportunities present themselves this might be done in human beings in cases of traumatic surgery of the chest), and finally correlation with those roentgenograms during life in which a fortuitous combination of factors makes contrast between the aortic and vena cava borders.

At the present time, I have no information concerning the second method and shall confine my remarks to the others.

Fig. 3*b*. Diagrammatic outline of Figure 3*a*. Comparing this with Figure 2*d* it will be noted that these plaques occupy the position of the aortic wall, and a line joining them reveals direct continuity. This is shown as evidence to verify the position of the aorta in vivo, as viewed in the injected cadavers.

Fig. 4. Roentgenogram of a patient with an azygos lobe. The concave pleural reflection will be noted in the median third of the right apex, attached to the superior vena cava. The border of the latter extends quite definitely beyond that of the spine. This is also given as evidence to verify the position of the aorta in vivo.

Hwiliwitzkaja[12] states that an aorta tied at both ends which at 40 mm. Hg has a volume of 25 c.c. may have a pressure of 120 mm. if an additional 25 c.c. is added. The volume is taken from the origin at the aortic orifice to the bifurcation. According to her figures, I would calculate that such an aorta at 120 mm. Hg would have a circumference of 65 mm. or 20.6 mm. diameter just above the valves. She also states that distensibility is greater at first, decreasing later with higher pressure. From this I would be led to believe that had I been able to obtain a pressure in the aorta approximating the normal, the caliber would have been but slightly increased over that noted in Figure 2*d*.

In all such deductions from post-mortem experimentation, there is one factor existing during life that must not be neglected, namely, the nervous control of the aorta exerted through the vagus and sympathetic nerves. The force of contraction or relaxation thus exerted is probably a variable factor.

Having established the probable contour of the aorta and superior vena cava, let us correlate these with observations of Figure 3*a*, where curved calcified plaques will be noted in the region of the left superior border of the arch, and just within the right margin of the supracardiac shadow near the base. It is obvious now, comparing this with Figure 2*d* that these shadows are continuous and represent the aortic contours.

Figure 4 is a roentgenogram of a patient with an azygos lobe, recently described by Bendick and Wessler.[1] The azygos pleural reflection will be seen attached to the superior vena cava, the border of which corresponds with that noted in the injections.

Figure 5*b* reveals the relationship existing at 90 mm. Hg pressure in an individual thirty-four years of age. A potential space

Fig. 5*a*. Posteroanterior roentgenogram made 8½ hours post mortem. Note cannulas inserted into right jugular vein and right and left common carotid arteries. Compare cardiac and supracardiac borders with those noted in the following figures.

will be noted between the aorta and superior vena cava. Undoubtedly this space is diminished in whole or in part during life. That the diaphragmatic level exerts a great influence is demonstrated in Figures 2*f* and 2*g*. The presence or absence of this space will be decided when observations are made before and after death in animals and human beings as previously indicated. At any rate, I believe it is safe to assume that normally the aorta does not surpass the right margin of the superior vena cava. *This can be accomplished only by an aorta distended beyond the normal*

When one correlates the injected specimens with normal roentgenograms, the variations in shape of the supracardiac shadow existing during life can readily be appreciated. There may be a variable space between the superior vena cava and the aorta. The limbs of the aortic arch may be closely approximated or widely separated. That the level of the diaphragm influences greatly the latter characters is demonstrated in Figures 2*f* and 2*g* where an attempt was made to simulate this condition by displacing the heart.

In Figure 6 I have attempted to construct the relation existing between the various structures comprising the supracardiac shadow in a normal sthenic adult. The relation of the pulmonary arc and left auricle was obtained from Figure 5*b*. It will be noted that the air injected into the aorta had returned through the veins by way of the superior and inferior vena cava to the right auricle, then passed into the right ventricle and pulmonary artery, and finally into the left auricle. These observations are at variance with those of Chaperon[2] and others who attribute to the pulmonary artery the sole possession, normally, of the arc between the superior descending portion of the arch and the contour of the left ventricle.

All methods attempting to measure the aortic contours in the frontal plane after a

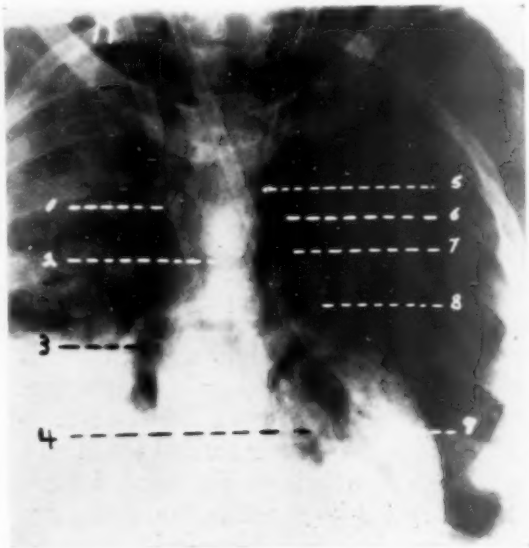

Fig. 5*b*. This individual was thirty-four years of age. Air was injected into the aorta 8½ hours post mortem. The pressure was 90 mm. Hg. Careful examination will reveal the following: 1. Superior vena cava. 2. Potential space between the former and aorta. 3. Right auricle. 4. Right ventricle. 5. Arch of aorta. 6. Beginning of descending aorta. 7. Pulmonary artery. 8. Left auricle. 9. Left ventricle.

Fig. 5c. Aorta injected with barium emulsion.

consideration of the foregoing facts must have many limitations and explains the discrepancies existing in the statements of various authors. Moreover, it must be recalled that the aortic arch does not assume a direct course from right to left in the coronal plane but is directed anteroposteriorly in a slightly oblique direction in the sagittal plane. Hence, methods based on the oblique positions are likely to give more accurate information concerning the aorta. In a search for an accurate method, the right anterior-oblique position of Vaquez and Bordet and the left anterior-oblique position of Chaperon, seemed to hold out the greatest promise. Until a method is obtained whereby contrast between the structures composing the supracardiac shadow is obtained, it will be necessary to rely upon indirect evidence.

Fig. 5d. Superior vena cava and aorta injected with barium emulsion. Note the potential space between them. Observe the position of the innominate veins, and branches of the aorta.

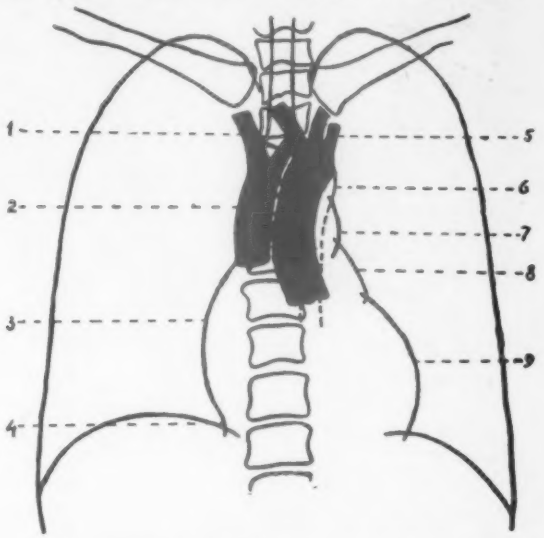

Fig. 6. Model sketch showing the normal relation existing between the structure comprising the cardiac and supracardiac shadows in the normal adult sthenic type: 1. Right innominate vein. 2. Superior vena cava. 3. Right auricle. 4. Inferior vena cava. 5. Left subclavian artery. 6. Descending aorta. 7. Pulmonary artery. 8. Left auricle. 9. Left ventricle.

TUBE MECHANICS AND THE NORMAL AORTA

Before discussing these methods, it would be advisable to consider tube mechanics. Figure 7 illustrates the changes that take place in an ordinary rubber tube under pressure, both ends of which were previously fixed in position. As the pressure is increased the limbs of the coil tend to separate and the arch becomes ele-

Fig. 7. Illustrating the changes that take place in an ordinary rubber tube under pressure, both ends of which were previously fixed in position. The shaded part is the original tube. The broken lines indicate the shape after pressure has been applied. Note that as the tube uncoils the limbs separate and the arch is elevated. At the same time the tube is distended (dilated).

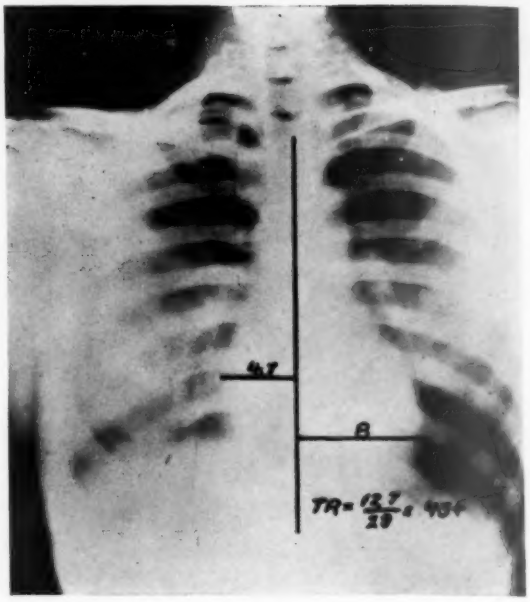

Fig. 8*b*. Teleroentgenogram showing measurements and transverse thoracic ratio of Danzer.
This roentgenogram was made at 7 foot distance, 6 to 10 sec. exposure and during quiet respiration. All teleroentgenograms were made in this manner.

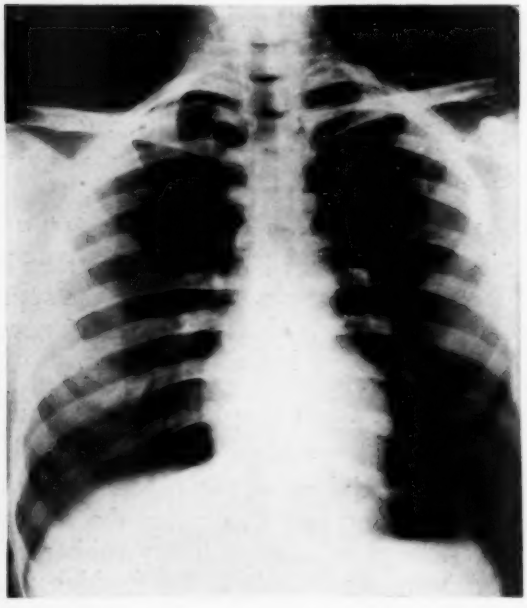

Fig. 8*a*. Roentgenogram of normal sthenic type, with retention of breath in inspiration, 1/10 second exposure, and 4 foot distance. The patient was a male, twenty-five years of age, 5′6½″ in height, and weighed 142 pounds.
Note that all roentgenograms of the chest of the normal and pathologic subjects were taken first in this manner.

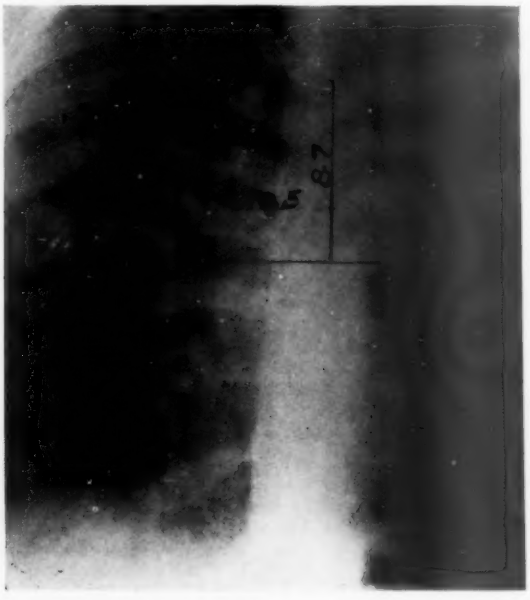

Fig. 8*c*. Left anterior-oblique roentgenogram made at 25° angle, 3 foot distance, 1/5 sec. exposure with retention of breath in slight inspiration. Note that the two limbs of the arch are distinctly separated. Compare this with Figure 7 to see how this position permits an appreciation of the degree of uncoiling. The measurements are used simply to aid the eye.

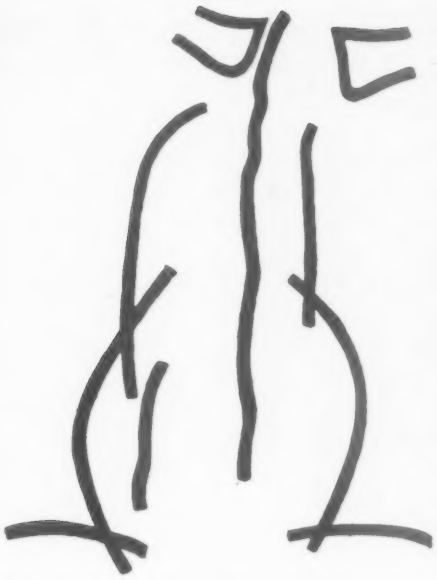

Fig. 8*d*. Diagrammatic outline of Figure 8*c*. Note that the right border of the ascending aorta presents towards the anterior chest wall and the left border of the descending aorta towards the spine. The right innominate vein extends from the right border of the ascending aorta towards the right sternoclavicular joint. The mediastinal borders cannot be made out.

Fig. 9*a*. Roentgenogram of the chest of the normal hypersthenic type; patient aged twenty-seven, height 6′2″ and weight 190 pounds.

vated. At the same time, the tube is distended. When water pressure is applied to a coiled tube such as in a garden hose, it tends to uncoil. It will be noted that as the tube uncoils, under pressure, its caliber increases. In elastic coiled tubes, the two go hand in hand. In other words, if the amount of uncoiling is measured, indirect evidence is obtained concerning the degree of distention. It is this study of the aortic uncoiling that has appealed to Chaperon.

Fig. 8*e*. Right anterior oblique roentgenogram made at 45° angle, 1/5 sec. exposure, and with the retention of breath in slight inspiration. All oblique roentgenograms were made in this manner.

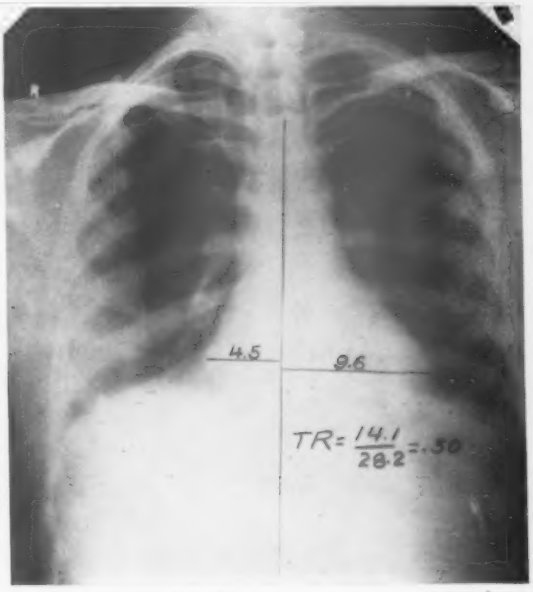

Fig. 9*b*. Teleroentgenogram.

Fig. 9*c*. Left anterior-oblique position.

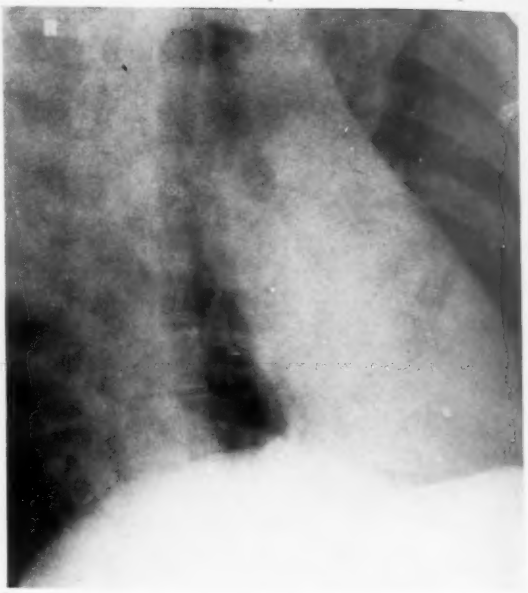

Fig. 9*e*. Right anterior-oblique position.

In Figure 2*c* taken in the left anterior-oblique position, about 25°, the two limbs of the arch are distinctly separated. This position should permit an appreciation of the degree of uncoiling. In rotating towards the left oblique, the aortic contour tends to overshadow the superior vena cava, so that the right border of the ascending aorta presents towards the anterior chest wall and the left border of the descending aorta towards the spine. The right innominate vein extends from the right border of the ascending aorta towards the right sternoclavicular joint. In Figures 8*c* and 8*d*, 9*c* and 9*d*, 10*c* and 10*d*, these borders are clearly visible. The left border of the ascending aorta and the right border of the descending aorta cannot be made out clearly due to obscuring shadows of the trachea and other mediastinal structures. Only those borders that are plainly visible are studied and measured. An attempt has been made to establish the normal measurements for this position. In these measurements only variations in centimeters should be considered.

Fig. 9*d*. Diagrammatic outline of Figure 9*c*.

Obviously the number is too small for establishing standard figures, but they do give a good idea of the normal variations. The level of the diaphragm exerts the same influence here as in cardiac measurements and due allowance must be made for it. In the distinct hypersthenic adult type, apparently the transverse measurement does

Fig. 10*a*. Roentgenogram of the chest of the normal hyposthenic type; patient aged twenty-three, height 5′1½″ and weight 140 pounds.

not exceed 11 or 12 cm. The transverse measurement seems to be more reliable than the longitudinal. Normally, the latter is difficult to obtain at times, since the

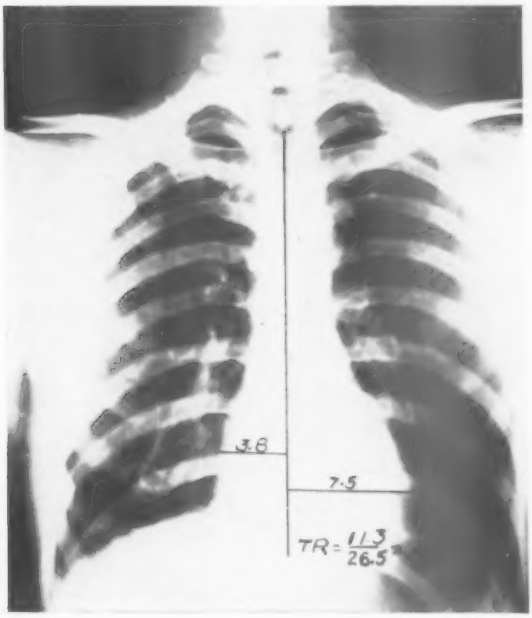

Fig. 10*b*. Teleroentgenogram.

Fig. 10*c*. Left anterior-oblique position.

mediastinal portion of the arch is obscured. It must be clearly understood that these figures are not to be taken per se. They must be employed simply to aid the eye. Following a study of the normal type of aortic uncoiling, the pathologic uncoiling is quite striking and easily diagnosed.

Fig. 10*d*. Diagrammatic outline of Figure 10*c*.

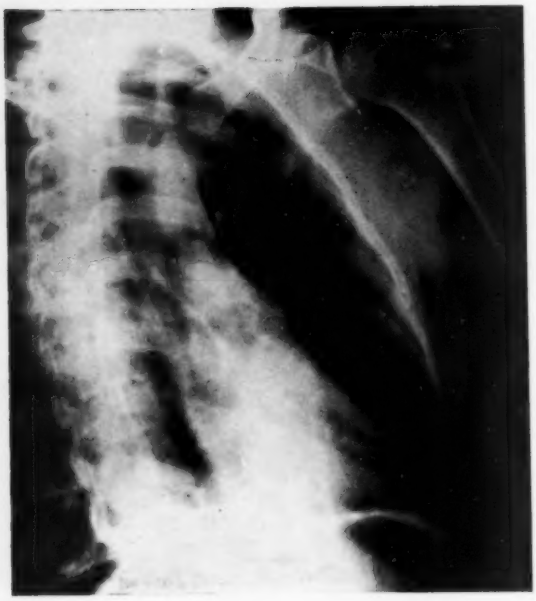

Fig. 10*c*. Right anterior-oblique position. Note that the posterior border of the shadow of the ascending aorta is in reality the left border of the trachea and left bronchus. Hence, a transverse measurement of the ascending aortic shadow in this view does not represent the true caliber of the aorta.

Chaperon employs the orthodiagraphic method and gives definite criteria for the left oblique position. However, for practical purposes, I believe the roentgenographic method has many advantages. The same considerations hold true here as in the discussion of teleroentgenograms.[9] The objection might be raised that the oblique views at 36 inch target plate distance would exaggerate contours. I believe that a comparison of the normal and abnormal findings will be convincing that this objection is not valid. There is no attempt here to minimize the value of the roentgenoscopic examination of the heart and great vessels. But I do believe that our knowledge of the aorta per se, is not enhanced by observations on pulsation and attempts to differentiate between the shadows cast by the aorta, superior vena cava and the trachea.

Figure 10*c*, as well as many other right anterior-oblique roentgenograms, reveals clearly that the border attributed to the aorta is none other than the left margin of the trachea and main bronchus.

Obviously, a measurement in this view as advocated by Vaquez and Bordet cannot be taken as a true figure for the aortic caliber. However, this does not destroy its value, aside from cardiac considerations. It demonstrates the aortic uncoiling, just as the left anterior oblique does, but not in so striking a manner. It is for this reason that the right anterior-oblique position of Vaquez and Bordet has not led us astray these many years although based on a false premise.

SUMMARY AND CONCLUSIONS

1. A review of the roentgen literature concerning the normal and pathologic aorta demonstrates that very little unanimity of opinion exists.

2. An attempt is made in this investigation to clarify the subject by the establishment of basic facts. The following methods were pursued:

(*a*) a study of the usual anatomic dissections, including cross-sections and a stereoscopic atlas;

(*b*) injection of opaque materials into the aorta and superior vena cava without disturbing the thoracic cage, after the manner of Chaperon;

(*c*) injection of air into the aorta under pressure;

(*d*) a consideration of ordinary tube mechanics;

(*e*) a correlation of these findings with roentgenograms of normal and pathologic subjects.

3. *The Normal Aorta*:

(*a*) Gross anatomic study shows that the superior vena cava is located to the right and slightly posterior to the aorta.

(*b*) The injection of opaque media into the vessels verifies the above findings and demonstrates a space between the superior

vena cava and aorta, especially in young adults.

(*c*) Realizing that the post-mortem aorta is contracted, an attempt was made to approximate the conditions in vivo by injecting air under pressure into the aorta. In these experiments the space between the aorta and superior vena cava was found to be diminished in adults, and in senility as the former is distended it overrides the latter and tends to approximate the right border of the superior vena cava but does not surpass it.

(*d*) Two patients, one with thin calcified plaques in the aortic wall, and the other with an azygos lobe, are cited as evidence to verify the above findings in vivo.

(*e*) The information derived from the foregoing is incorporated in a model sketch showing the normal relation existing between the structures comprising the supracardiac shadow.

TABLE I

NORMAL SUBJECTS

Age	Sex	Height	Weight Lb.	Left Anterior-Oblique Measurements of Aorta	
				Transverse cm.	Longitudinal cm.
25	F	5′8½″	143	6.6	6.7
26	M	5′7″	158	8.3	7.5
30	F	5′2″	130	6.2	6.6
30	F	5′	155	8.5	6.7
24	M	5′6″	134	7.0	8.0
19	M	5′5½″	136	7.0	6.8
29	M	6′2″	223	10.0	9.2
30	M	5′11½″	150	6.5	8.5
27	M	6′2½″	183	8.2	8.4
26	M	5′10″	170	8.5	8.5
26	M	6′2″	162	9.0	7.5
24	M	6′2″	220	9.5	9.3
33	M	6′	184	10.0	8.0
43	M	5′8″	194	8.0	8.0
30	M	6′1¼″	192	8.7	9.0
32	M	5′7½″	165	9.0	8.0
25	M	6′1″	180	8.0	7.7
26	M	5′10½″	158	9.0	8.8
25	M	6′½″	184	9.0	9.5
39	M	5′11″	230	11.0	8.7
25	M	5′11″	180	10.5	10.0
21	M	5′7″	129	6.7	7.7
29	M	5′11″	128	7.5	...
27	M	6′1½″	148	7.5	8.7
24	M	5′6″	102½	6.2	6.6
25	M	5′6″	128½	7.0	6.5
24	F	5′4″	132	6.0	7.7
34	F	5′2½″	132	7.0	7.2
23	M	5′1½″	140	8.5	8.6
27	M	6′2″	190	10.2	9.1
25	M	5′6½″	142	8.5	8.7
36	F	5′3″	110	9.2	8.4
19	F	5′4″	156	7.0	7.0
26	F	5′7″	107	6.2	6.7

4. A brief description of ordinary tube mechanics is given in which the method of uncoiling is considered. This is correlated with the uncoiling of a normal aorta and is illustrated. The left anterior-oblique position, about 25°, is the most satisfactory for demonstrating this uncoiling.

It is apparent from this study that until a method is found whereby contrast between the structures comprising the supracardiac shadow is obtained, we shall have to be content with indirect evidence concerning the aorta. Up to the present time, such evidence seems to be best obtained by a study of the aortic uncoiling in the left anterior-oblique position, as advocated by Chaperon. It is not to be understood that the other views of the chest should be neglected for the left anterior-oblique.

It is hoped that this method will prove of value in clinical studies concerning elasticity, contractility and volume of the aorta. These undoubtedly have important clinical bearing. It is necessary that we consider the aorta from the standpoint of mechanics and not be content with our present attempts at mere isolated estimations of its caliber.*

* For discussion see page 405.

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A STANDARDIZATION ROENTGENOLOGIC STUDY OF THE HEART AND GREAT VESSELS IN THE LEFT OBLIQUE VIEW*

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THE routine posteroanterior teleroentgenogram of the chest has become practically the standard procedure for heart measurements and diagnostic study. We are presenting an additional method of examining the heart which we feel offers considerable accuracy in defining the relation between the size of the right and left ventricles. This report is based upon a two-year anatomical and roentgenological study of the left oblique view of the heart and great vessels.

There have been many reports recommending the roentgenoscopic study of the heart and study by orthodiagraph in the posteroanterior and lateral views (Chaumet,[4] Langley[7]). For inspection of the left auricle and ventricle through the posterior mediastinum, Chaumet recommended roentgenoscopic study of the heart in oblique views with the patient at angles varying from 40° to 60°. Brown and Weiss[3] suggested a straight lateral roentgenogram, but their division of the heart outline was not based upon anatomical facts. In the left lateral view, with the left side toward the film, the whole heart silhouette is formed by the left ventricle and auricle, which view would be an excellent method for studying the size of the left ventricle alone.

The left oblique posteroanterior teleroentgenographic (or orthodiagraphic) technique which we will describe in detail offers the only way of comparing the right and left ventricular size without interference from overlapping auricular shadows. Area measurements are more accurate that those in the posteroanterior view and give a better index of cardiac volume. The great vessels can be measured and studied to greater advantage than from any other single aspect.

ROENTGENOLOGICAL TECHNIQUE AND ANATOMICAL BASIS FOR THE METHOD

The patient is roentgenoscoped in the usual manner in the standing or sitting position. A careful study of the heart is made from all sides. After all the information possible is obtained concerning heart function, and the pathology is noted, the patient is rotated from 40° to 60° from the posteroanterior position to the left oblique position to obtain the best possible view of the aorta and pulmonary vessels. It has been found that in this position the apex of the heart points towards the examiner. Then the right ventricle is seen to its greatest extent on the right side of the heart silhouette. If the patient is directed to take and hold a deep inspiration, the pulmonary artery usually stands out sharply. The pulmonary artery is sometimes better visualized immediately after a cough. In this instance, it almost completely fills the space beneath the aortic arch. The patient's position in relation to the roentgenoscopic screen is noted. The patient is then placed against the film cassette holder in exactly the same position. This usually means that the left clavicle is placed as nearly parallel to the film as possible. The right shoulder is about 8 to 10 inches from the film. The right hand is placed on top of the head. The patient is instructed to take a deep inspiration and to hold it during the exposure. This not only fills the lungs with air and offers better con-

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Fig. 1. Anterior view of normal female cadaver with sternum and left chest wall removed. The pericardium has been removed.

Fig. 2. Oblique view of same case as Figure 1 showing the relation of the pulmonary artery and the left auricle.

trast between the heart and vessels, but it depresses the diaphragm and liver shadow below or nearly to the lower edge of the heart. In some patients, the heart is well above the diaphragm at this time, and the inferior vena cava is clearly seen.

This method of placing the patient in position following roentgenoscopic study of the heart with special note of the correct position for the best oblique view has given the most consistent results. An arbitrary fixed angle is not possible because of the variation in the position and direction of the apex and vessels in the thorax (Nichols[8]). Since all patients are roentgenoscoped in this clinic, this procedure does not lengthen the examination but is done automatically during the routine roentgenoscopic examination of the lungs and heart. After an exposure for the oblique roentgenogram in this position, a routine posteroanterior roentgenogram is made.

The factors for our equipment are as follows: 6 foot target-film distance, broad focus universal type Coolidge tube, 150 ma.; for the posteroanterior view, 1/10 second; for the oblique view, 2/10 second. The voltage varies with the thickness (posteroanterior) of the chest, i.e., 6 inch, 60 kv., to 12 inch, 100 kv.

Before discussing the measurements to be made upon the roentgenograms, let us study the anatomical relations of the various parts of the heart as cast upon the film in silhouette form. In order to interpret the roentgenogram, we must reduce the anatomical structures to one plane much as an architect projects his building in plan and elevations upon a blue print.

Let us consider the thoracic organs as they appear in a dissection (Figs. 1 and 2). Looking at the open thorax from the front, we have the same silhouette that is seen with the roentgenoscope and shown by the teleroentgenogram. The apex of the heart is to the left near the middle of the lung field. The right auricle is a thin crescent capping the right border of the right ventricle. No part of the right ventricle makes up the heart outline. The superior vena cava forms the extreme right border from the right auricle to the clavicle level. Medial to this, but often to the right of the sternum,

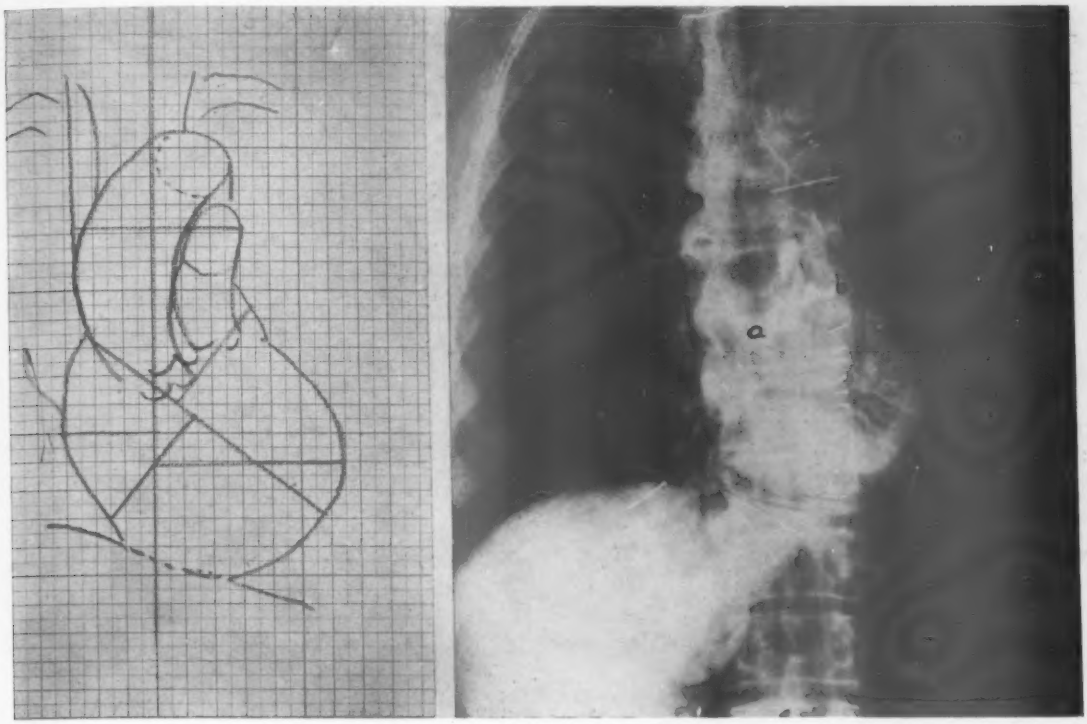

Fig. 3. A posteroanterior teleroentgenogram of the cadaver similar to Figure 1, with a tracing made from the film. The aortic valves (*a*) and the pulmonary valves (*b*) are outlined by barium which is very dimly seen in the film.

is the denser shadow of the ascending aorta and the right innominate artery.

To the left of the sternum, the aortic knob and descending aorta, the left pulmonary artery and its branches, the left auricle and its appendage, and the left ventricle, each takes part in forming the rather wavy left border of the silhouette of the heart and vessels.

If the dissection is revolved clock-wise 45° on its vertical axis, the apex of the heart shifts to the right (or the observer's left) just enough to silhouette the right and left ventricles to their maximum extent. The *right* auricle has disappeared behind the right ventricle. The *left* auricle has come forward and its appendage lies on top of the left ventricle so that it plays very little part in the silhouette. The tip of the left auricle lies across the upper or cephalad portion of the silhouette between the pulmonary artery and the cephalad corner and edge of the left ventricle. The circumflex branch of the left coronary artery practically makes the edge of the ventricle here. The tip of the auricular appendage fills the space, then, between the edge of the ventricle and the pulmonary artery with a definite notch between them.

The pulmonary artery and the aorta are visible in their greatest extent in this view (Fig. 2).

If glass plates are placed in front of the dissection and silhouettes are drawn of the heart and vessels in each view (Figs. 3 and 4), these will correspond to the outlines visible in the roentgenograms taken of this specimen in what corresponds to the posteroanterior and left posteroanterior oblique views (Figs. 5 and 6). Silhouette tracings of these roentgenograms (Figs. 7 and 8) correspond in exact detail to the silhouettes made upon the glass plates (Figs. 3 and 4).

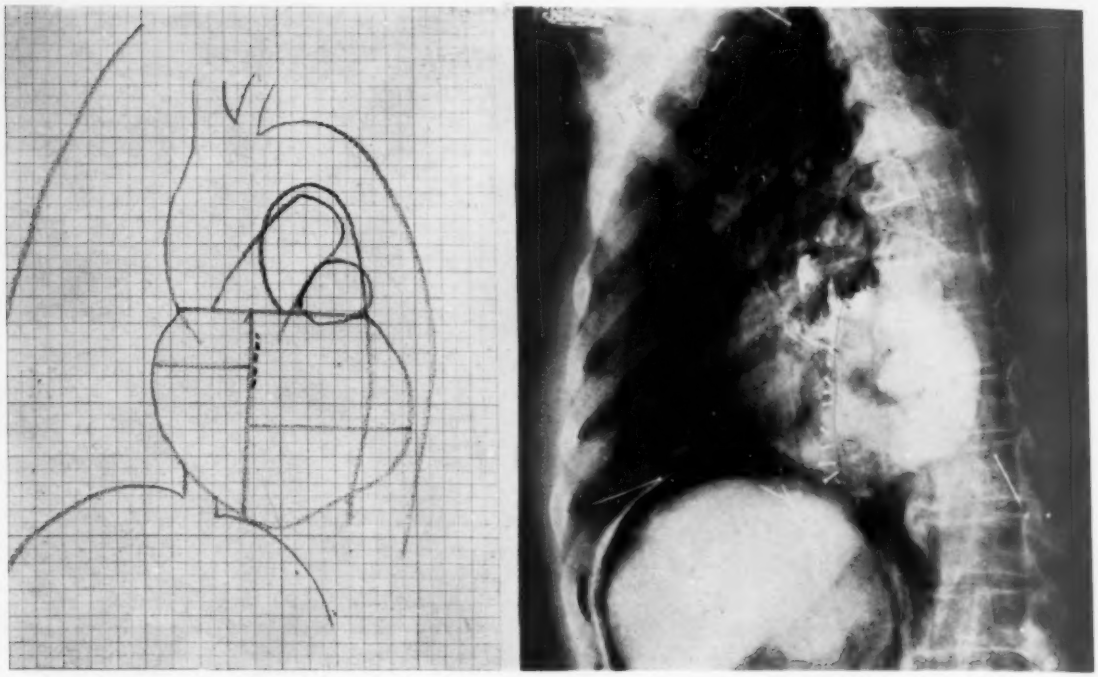

Fig. 4. A teleroentgenogram of cadaver (see Fig. 2), left oblique posteroanterior postion, with the tracing made from the film. The interventricular septum is outlined in the film by a row of pins. The deviation of the septum from a straight line is shown in dotted line in the tracing. Barium was placed on the pulmonary and aortic valves to locate them in the film in relation to the vessels.

In the oblique view, a line may be drawn upon the glass plate, or the roentgenogram, or its tracing across the silhouette of the heart from the notch between the right ventricle and the aorta to the notch between the left auricle and the left ventricle. This line crosses, and may be said to form, the base of the two ventricles; and we have called it the *base line*. The pulmonary artery and the aorta ordinarily overlap each other at their bases about half of their respective diameters. If a straight line is drawn along the interventricular septum, it passes through the middle of this overlap across the base line, dividing it into a right and left portion. This line along the interventricular septum, dividing the two ventricles from each other, happens to be perpendicular to the line across the base of the ventricles. This can be visualized readily by inspection of the dissection (Fig. 6) and then of the teleroentgenograms of the same with pins in the interventricular septum (Fig. 4). Examination of two normal cadavers and three post-mortem cases with normal hearts *in situ*, ten anatomical specimens and all the anatomical charts available seemed to show that if the heart is viewed in the oblique view so that the pulmonary artery and the aorta overlap as described, the septum is practically always perpendicular to the base line.

Method of Study

With the anatomical relations in mind, tracings are made upon ordinary millimeter graph paper from the usual posteroanterior teleroentgenogram and the left oblique posteroanterior teleroentgenogram described. When the outline is somewhat faint, this is touched in lightly with a "glass" pencil as can be seen from some of the figures shown here. For routine purposes, the usual measurements may be

Fig. 5. Photograph of the mounted dissection showing the silhouette of the heart outline as seen from the anterior view corresponding to the teleroentgenogram from the posteroanterior view. Compare the heart outline with the tracing from the film in Figure 3.

Fig. 6. Photograph showing the mounted dissection from the oblique view. The outline and vessel silhouettes correspond to the tracing made from the left oblique teleroentgenogram of this cadaver. Compare with Figure 4.

directly upon the film, but if areas are to be computed, tracings must be made. The area is computed with a planimeter.

In the posteroanterior view a straight line is drawn across the base of the great vessels from the notch between the right auricle and the aorta to the notch between the pulmonary artery and the left auricle when this is visible. Often this location on the left border has to be guessed at. The lower border of the heart, especially in the larger, ones, has to be drawn in by guess for distances of from 5 to 20 cm. These two sources of error make a great deal of difference in computing the area.

In the left oblique view, the base line is drawn from the notch between the right ventricle and the aorta to the notch between the left ventricle and the left auricle or, if the latter is not visible, to the upper corner of the left ventricle. The point midway between the overlapped portions of the aorta and pulmonary artery is located and a perpendicular to the base line is drawn down from this to the lower border of the heart. This is the line along the interventricular septum. Lines perpendicular to this are drawn to the left and right to measure the width of the left and right ventricles. The diameters of the aorta, pulmonary artery, and aortic arch are then constructed.

The area is computed of that portion of the heart enclosed by the heart outline below the base line. This area, as shown by the anatomical study, includes only the ventricles and no portion of the auricles. This fact should be emphasized for the area of the heart viewed from the left

Fig. 7. Normal posteroanterior view—outline slightly retouched. (See Fig. 14, middle case.)

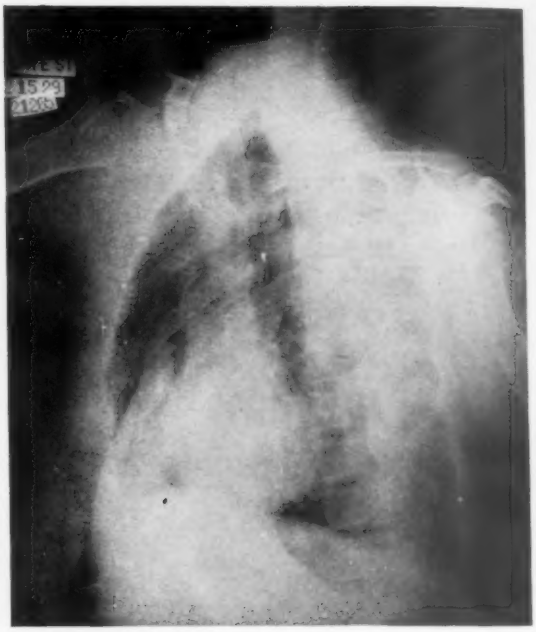

Fig. 8. Left oblique posteroanterior view of same case—untouched.

oblique aspect must give a truer index of cardiac *ventricular* dilatation or hypertrophy than the area measured from the posteroanterior view. After all, ventricular size and muscle power determine the rate of blood flow and are the important criteria of heart function.

DISCUSSION

Figures 14, 15 and 16 show the tracings of a series of normal hearts from the small short type to the long tubular type. In the oblique view, the normal heart is identified quickly by the flat outer edge of the right ventricle. For simplification of comparison in this preliminary study, all of the cases showing a preponderance of right ventricular and left ventricular enlargement or a general dilatation were grouped together. This enabled us to study the measurements in four groups (including the normals). The chart illustrates the average results of the study of 61 clear-cut cases. The extremes in each group, of course, merge into the other groups some-

Fig. 9. Same case as shown in Figures 7 and 8 with outline of great vessels retouched for comparison with Figure 8. (See also Fig. 14, middle case.)

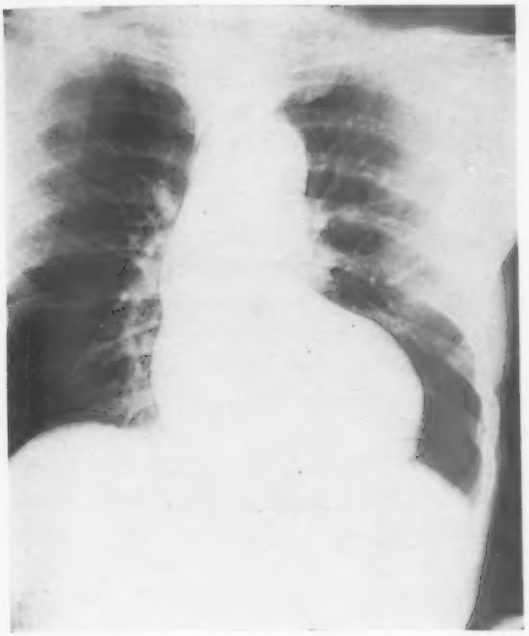

Fig. 10. Posteroanterior view of a case showing tremendous left ventricular enlargement and a tortuous aorta. There is no indication of the size of the right ventricle gained from this view. The right auricle is somewhat enlarged to the right.

Fig. 11. Left oblique posteroanterior view with outline drawn in. The aorta in addition to being tortuous is dilated in the lower portion of the ascending arch. This is probably due to arteriosclerotic changes. The extreme right ventricular, as well as the marked left ventricular enlargement is visible. The left auricular appendage is dilated. Wassermann reaction, negative; blood pressure, 220/140. Clinical diagnosis: arteriosclerotic and hypertensive heart disease, chronic nephritis. (See Fig. 17, No. 3.)

what, but in general they all fall readily into major groups. No attempt has been made to classify these cases according to valvular lesions. In the main, the cases are those without valvular lesions.

A gross study of ten abnormal hearts in the museum shows the base line and the septum, as denoted by the coronary arteries, to be perpendicular to each other when the aorta and pulmonary artery are overlapped. The base line is tilted up or down at the left depending upon the size of the left ventricle. The right ventricle does not seem to influence its position much. This is borne out in the tracings of large hearts. The lowest point in the normal heart outline seems to be a little to the left of the junction of the right and left ventricles at the septum. It is obvious that a marked left ventricular hypertrophy might shift this lowest point a centimeter or two. Inspection of the tracings indicates, however, that a rather marked shift of the lower end of the perpendicular line along the septum would not change the transverse measurements greatly.

There are two interesting groups of cases, sample tracings of which are shown. One type of heart (Fig. 21) in the posteroanterior view, shows an enlargement downward and to the right which is as great as that to the left. This suggests a considerable increase in the size of the right ventricle. The tracings in the left oblique view bear this out very strikingly. The other type of heart (Fig. 20) comes fairly well within the normal limits for shape and size in the posteroanterior view or it may show some left ventricular enlargement.

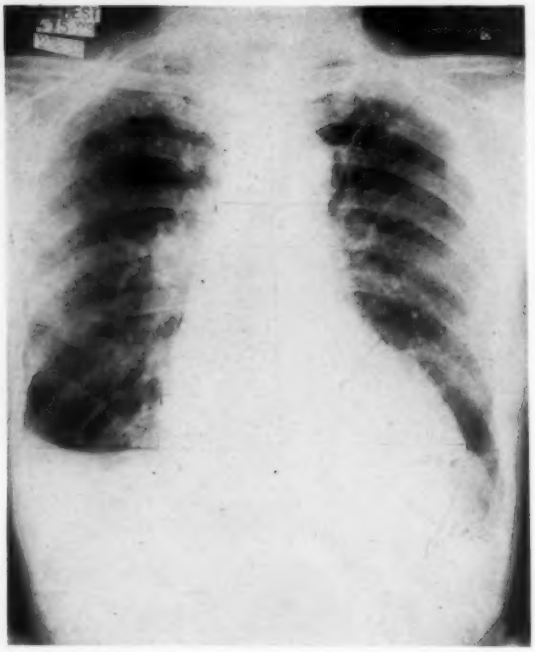

FIG. 12. Extreme dilatation of whole heart. Lower border obscure. (See Fig. 19, No. 3.)

The left oblique view discloses, however, a considerable enlargement of the right ventricle greatly out of its normal proportion to the left ventricle. Most of these two types of cases were near exitus, or in the acute phase of some disease with fever, or suffering from some pulmonary disorder such as emphysema or asthma.

The average area measurements of the normal hearts in the posteroanterior view are slightly lower (108 sq. cm.) than many published results, probably because the short exposure gives a sharp heart outline. A long exposure over a complete heart cycle registers as part of the area of the heart outline any change in position of the heart during systole or diastole, i.e., elevation of the apex. This error may be considerable in an active muscular heart. The straight line instead of the curved line across the base of the heart also reduces the area (Bardeen,[1,2] Eyster[5,6]). In the left oblique view, the area computations depend upon a straight line between two clear and definite landmarks across the base of the heart and, in most cases, a clear, well-defined lower border. While there may be some doubt in computing areas in the posteroanterior view of the heart because of errors in interpolating boundaries, there is no doubt about the results in the oblique view if the exposure has been correctly made.

In large hearts, difficulty may occur in not using the correct multiplying factor for certain planimeters. Since the tracings are done on millimeter graph paper, the area can be checked quickly by counting the squares.

There is consistent increase in the diameter of the aorta, pulmonary artery and width of the swing of the aortic arch in the enlarged hearts from all causes. This is probably influenced by the high incidence of arteriosclerosis in this series of cases.

For the purpose of developing a standardized method of procedure, these cases

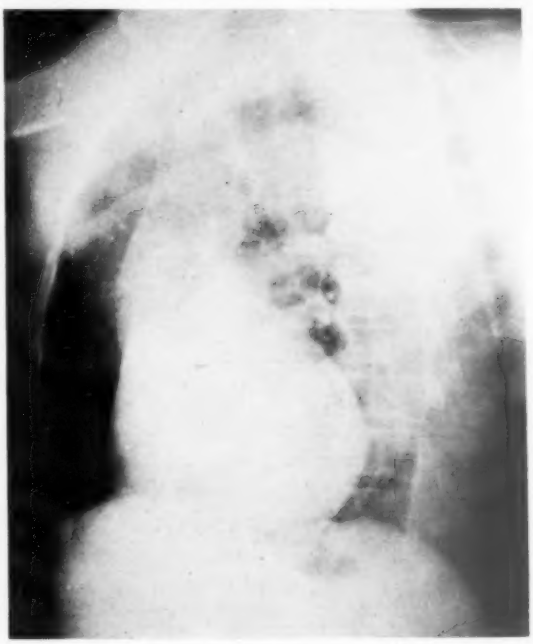

FIG. 13. Left oblique view of the same case as Figure 12 showing the general enlargement with the preponderance in the left ventricle; very tortuous aorta. (See Fig. 19, No. 3.)

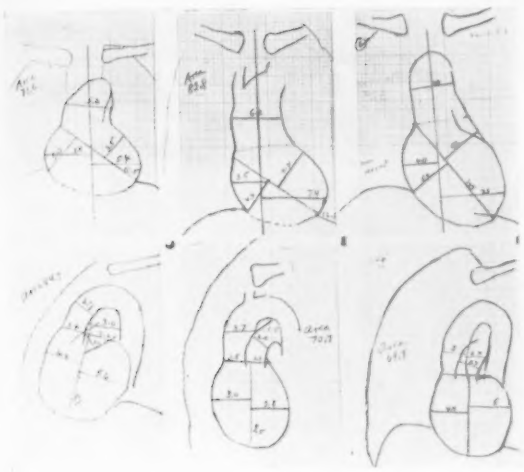

Fig. 14. Showing tracings of three normal hearts of the transverse or bulbous type from individuals of short stature. (See Figs. 7–9 for middle case.)

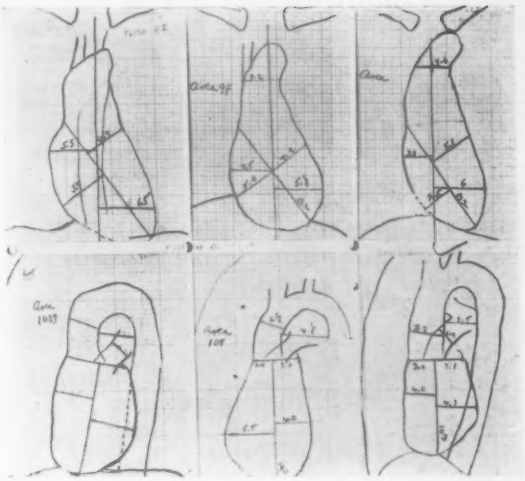

Fig. 16. Showing tracings of three normal hearts of the tubular or long type in individuals of the tall or asthenic type.

have been taken haphazardly as they came through the clinic. For this reason, a simple classification of the types has been used, and the figures in Table 1 cannot be taken as final. The next step is to bring about a clinical correlation with the results of the measurements upon the basis of definite pathological entities.

This study has already brought to notice several cases of dilatation of the ascending aorta in non-luetics which are probably arteriosclerotic in origin. One such case with a negative Wassermann reaction and a dilated aorta, proved at autopsy to have only arteriosclerosis.

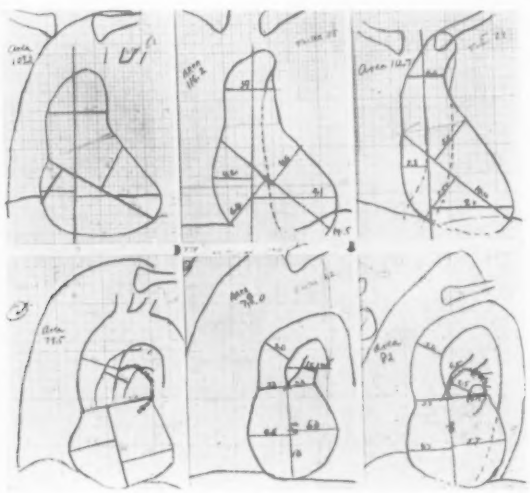

Fig. 15. Showing tracings of three normal hearts of the intermediate type.

SUMMARY AND CONCLUSIONS

A technique for making a routine standard left oblique teleroentgenogram of the heart is described.

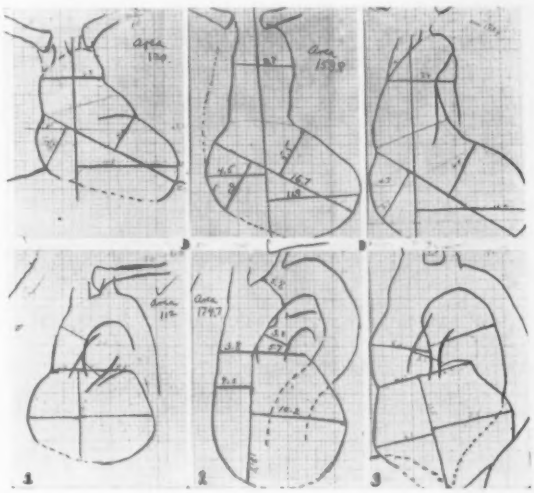

Fig. 17. Tracings of three hearts showing pronounced left ventricular enlargement. There is, of course, considerable right ventricular enlargement as well. (See Figs. 10 and 11 for originals of No. 3.)

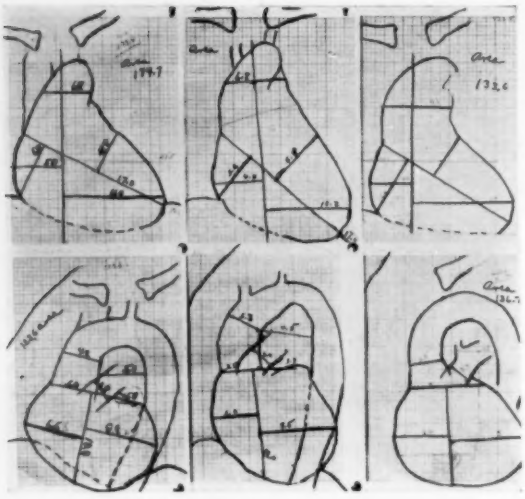

FIG. 18. Tracings of three moderately enlarged hearts.

The anatomical basis for the various measurements possible with this technique is demonstrated.

Certain types of cases show a right ventricular perponderance which is unsuspected in the usual posteroanterior teleroentgenogram, though of course it is visible in the roentgenoscopic study of the heart which should be made in every case if possible.

Area measurements are based upon well-defined anatomical landmarks and should be more accurate than those made upon the posteroanterior roentgenogram.

The great vessels are well defined in the oblique view and can be measured and studied statistically.*†

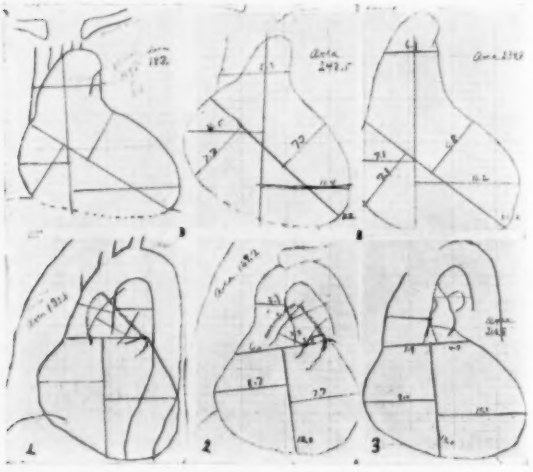

FIG. 19. Showing tracings of three markedly enlarged hearts with profound myocardial damage. (See Figs. 12 and 13 for originals of No. 3.)

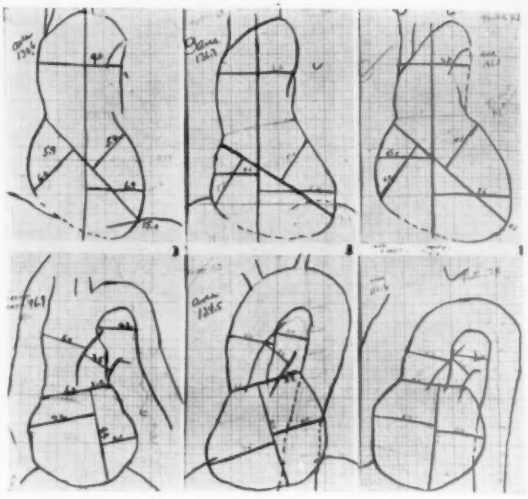

FIG. 20. The posteroanterior tracings of three somewhat enlarged hearts show enlargement to the right and downward suggesting right ventricular enlargement which is strikingly demonstrated in the left oblique view.

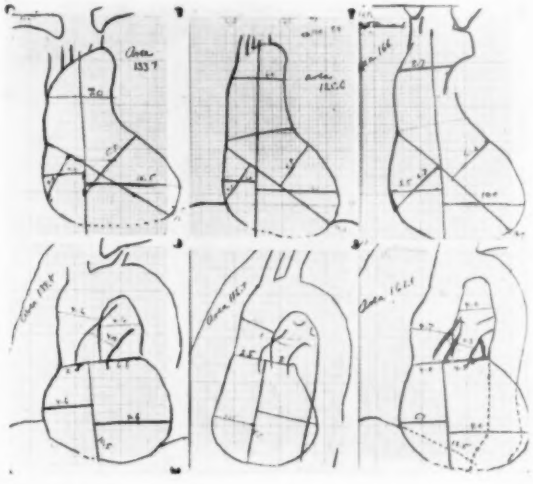

FIG. 21. The posteroanterior tracings show no evidence of a right ventricular enlargement though there is definite right auricular enlargement. The oblique tracings show definite right ventricular enlargement.

* We wish to express our great appreciation of the assistance given us by Dr. George W. Corner, Professor of Anatomy, in our study of the anatomical materials. We also wish to thank Dr. Walter Fray for his help in making some of the measurements and for studying the posteroanterior views.

† For discussion see page 405.

TABLE 1

COMPARISON OF AVERAGE MEASUREMENTS

	Left Oblique View										Posteroanterior						
	No. of Cases	Right Base	Left Base	Right Ventricle	Left Ventricle	Septum	Ascending Aorta	Pulmonary Artery	Aortic Arch	Area	Great Vessels	Right Auricle	Left Auricle	Right Ventricle	Left Ventricle	Longitudinal Diameter	Area
Normal Hearts	31	3.3	3.5	4.9	5.2	10.8	3.4	2.4	3.7	91.2	5.1	4.1	5.1	5.3	6.9	13.6	108.0
Right ventricular dilatation or hypertrophy	7	3.9	3.4	6.7	7.0	11.3	4.3	3.0	4.4	114.3	7.3	5.4	5.0	6.0	8.0	15.3	136.9
Left ventricular dilatation or hypertrophy	13	3.6	4.7	5.3	8.0	11.3	3.8	2.9	5.0	117.4	6.7	4.6	5.5	5.7	10.1	16.1	139.4
General dilatation	10	4.5	5.1	6.9	8.6	13.1	4.0	3.0	4.8	174.6	6.4	5.9	6.2	6.6	11.3	18.8	188.8

Table showing comparative measurements from the posteroanterior and the left oblique views. The values for the areas are somewhat uncertain for the posteroanterior views while those for the oblique views are accurate.

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ROENTGENOLOGICAL AND PATHOLOGICAL FINDINGS IN SOME OF THE VALVULAR LESIONS*

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THE material for this paper is drawn from the roentgenological and pathological departments of the Cleveland City Hospital. The cases have been selected for this presentation and only the proved lesions are demonstrated. The roentgen method consisted in a roentgenoscopic examination and teleroentgenograms taken in the sagittal and both oblique views.

In order to intelligently interpret pathological changes in the cardiac silhouette it is absolutely essential to know the relation of the various chambers in the normal in the different positions. The diagrams bring out these positions (Figs. 1, 2 and 3). This normal silhouette varies considerably in different individuals and the normal factors responsible for this variation, especially the size and shape of the thorax and the position of the diaphragm, must always be considered.

The enlarged heart gives a change in form not seen in the normal and such a heart differs geometrically from the normal. The difference is sometimes very slight. We must accept the statement of Assmann that "genuine hypertrophy causes chiefly a change in shape, yet no marked general enlargement of the heart." In other words, hypertrophy causes a change in shape and dilatation a change in size.

Since the majority of valvular lesions involve the left side, I have chosen to take up briefly the changes in the silhouette secondary to lesions of the aortic and mitral valves. The chambers we are primarily interested in are therefore the left ventricle and the left auricle.

The best-known sign of enlargement of the left ventricle is an increase of the left median distance. In pure hypertrophy this enlargement is slight. It increases

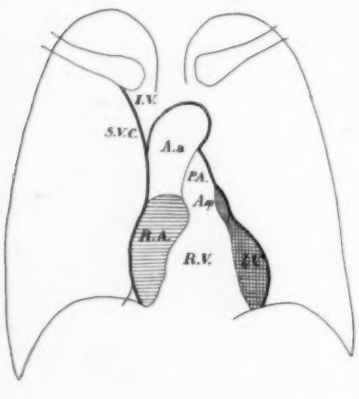

Fig. 1. Diagram of the normal heart in the anteroposterior position.

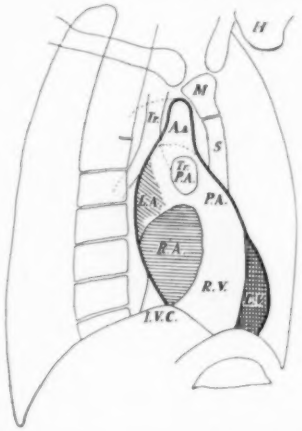

Fig. 2. Diagram of the normal heart in the first oblique position.

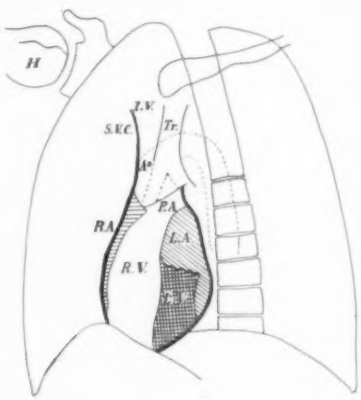

Fig. 3. Diagram of the normal heart in an exaggerated second oblique position.

S.V.C., Superior vena cava; I.V., Innominate vein; A.a., Ascending aorta; P.A., Pulmonary artery; A.ap., Left auricular appendage; R.V., Right ventricle; R.A., Right atrium; L.V., Left ventricle; I.V.C., Inferior vena cava; L.A., Left atrium; Tr., Trachea; Tr.P.A., Cross section of the pulmonary artery; M., Manubrium; S., Sternum; H., Head of humerus.

* From the Roentgenological and Pathological Departments of the Cleveland City Hospital, Cleveland, Ohio. Read at the Thirtieth Annual Meeting, American Roentgen Ray Society, New York City, Sept. 17–20, 1929.

with the amount of dilatation present. This increased distance is responsible for the silhouette assuming that of an obliquely placed ovoid. The ventricular outline may now assume one of two curves: elliptical, suggesting hypertrophy, or parabolic, suggesting dilatation. With either, the junction of the left auricular appendage and the left ventricle becomes sharply defined. When dilatation is largely responsible for the enlargement the curve of the left ventricle becomes less marked, the apex less plump and the pulsations less well defined. Again on deep inspiration the normal cardiac apex is elevated upwards away from the dome of the diaphragm. If this movement is absent hypertrophy can be assumed. A study in the second oblique position will confirm the above. In this view if the left ventricle is increased the bi-diaphragmatic angle stays within the heart shadow in all phases of respiration. Therefore in establishing an enlargement of the left ventricle we have the following signs:

(1) Increase in the left median distance and horizontal diameter.
(2) Sharply defined junction between the left auricular appendage and the left ventricle.
(3) Absence of elevation of the apex on deep inspiration.
(4) Elliptical to parabolic left lower arch.
(5) Change in pulsations.
(6) An obliquely placed ovoid silhouette.
(7) The bi-diaphragmatic angle remains inside the heart shadow in the second oblique view.

Enlargement of the left atrium is predominantly due to lesions of the mitral valve. It can be absent rarely in mitral stenosis. The chamber can be enormously dilated in so-called aneurysmal dilatation of the left auricle. Such cases are rare. Being posterior, the left atrium is best observed in the first oblique position. When enlarged it bulges into the midportion retrocardiac space (Fig. 4). In early cases it merely encroaches on the space, but in more advanced dilatation the space is obliterated. The rounded shadow of the atrium will then overlie the spine shadow,

Fig. 4. Mitral stenosis in the first oblique view. The midportion of the retrocardiac space is obliterated by the enlarged left atrium.

leaving the upper portion of the retrocardiac space of normal radiability and characteristically a triangular shadow of normal radiability in the lower portion. At this stage it is sometimes seen in the anteroposterior view, either as a shadow of increased density through the lighter shadow of the right atrium, or projecting beyond the latter to form a separate arch between it and the right hilus (Fig. 10). In extreme cases it can form the entire right border of the cardiac silhouette. In the second oblique diameter in the presence of an enlarged left atrium the bi-diaphragmatic angle lies between the heart and spine shadow on deep inspiration, but enters the heart shadow on expiration.

Having established an enlargement in the left ventricle or the atrium, or both, it is not difficult to diagnose the valvular lesion responsible. Lesions other than val-

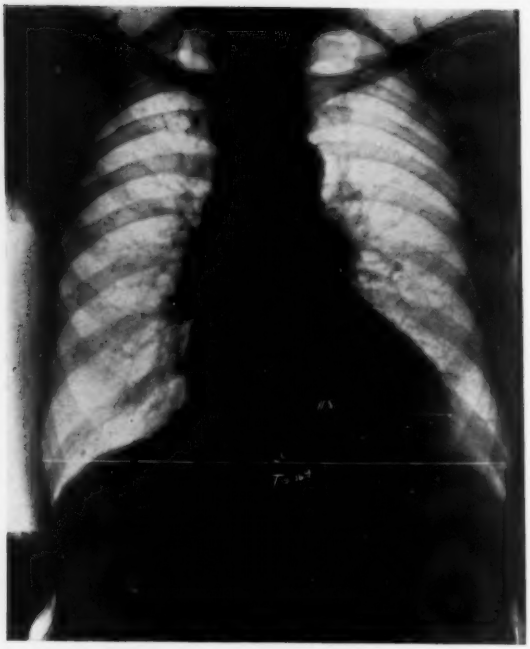

Fig. 5. Aortic stenosis.

vular causing left ventricular enlargement must not be forgotten.

AORTIC STENOSIS

In aortic stenosis (Fig. 5) the roentgenoscopic observation is very important, because the pulsations are characteristic. Their rate is slow and pulsation is forceful. They increase gradually and are neither jerky nor weak. Hypertrophy is the predominating change in the left ventricle and hence the left median distance is not greatly increased. The left lower arch is bulged. Even though there are no signs clinically of dilatation the cardiac apex on the roentgenogram is often spread, a finding which is definite evidence of dilatation. There is also described an associated occasional dilatation of the ascending aorta even when there is no insufficiency. The explanation given for this by Volhard and quoted by Assmann is that "This post-stenotic dilatation represents the hydraulic explosive effect from the forcibly propelled compressed blood jet on the stagnating column of the great vessels."

AORTIC INSUFFICIENCY

In the majority of cases the most striking change is the marked increase of the left median distance (Fig. 6). This is due largely to dilatation rather than hypertrophy. The left lower arch becomes rounded and the cardiac cone assumes a horizontal position. Its border is raised from the diaphragm. The great vessels appear to ride on the horizontal portion, giving a silhouette variously termed "duck", "shoe-shaped" or "recumbent ovoid." Pulsations rapidly increase (pulsus celer). This is even more striking in the ascending aorta and can be easily made out in the second oblique position. The aorta appears dense and dilated in all its diameters. The ascending aorta projects to the right of the shadow of the spine and the superior vena cava.

MITRAL STENOSIS

The signs of mitral stenosis have been described elsewhere and include:

(1) The heart is in the erect position and appears long and narrow (Fig. 7).

Fig. 6. Aortic insufficiency.

(2) The left border is straight, the incisura is filled out by the pulmonary artery and the left auricular appendage.
(3) The left median distance in uncomplicated cases is small.
(4) The aortic shadow is insignificant or entirely hidden in the shadow of the spine.
(5) The second left arch (pulmonary artery) joins the aortic knob high up.
(6) The pulmonary artery is increased in prominence.
(7) The right auricular curve is elongated and joins the aorta or superior vena cava higher than normally.
(8) The hilus regions are increased.
(9) The enlarged left atrium encroaches upon the retrocardiac space.
(10) The esophagus is sometimes displaced.
(11) The angle of bifurcation of the trachea is sometimes increased due to the enlarged left auricle.

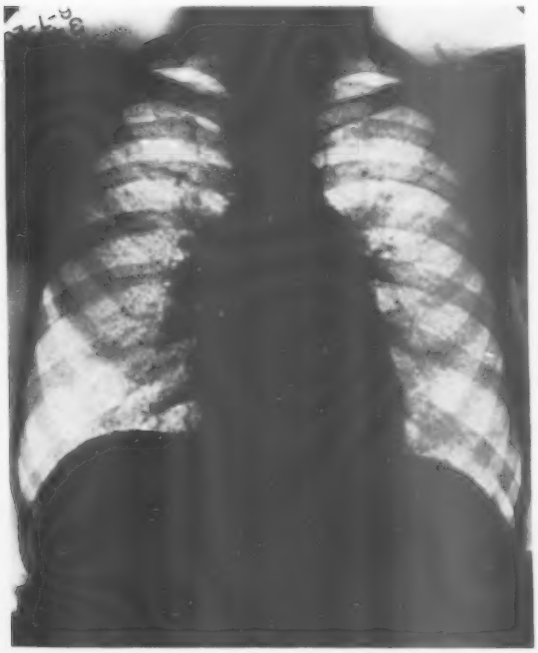

Fig. 7. Mitral stenosis.

Fig. 8. Mitral insufficiency.

MITRAL INSUFFICIENCY

The mitral configuration which is so constant for all mitral lesions is maintained. In its pure form or where it predominates markedly mitral insufficiency can scarcely be confused (Fig. 8). The left median distance is increased. This is due to left ventricular enlargement. The transverse diameter now either approaches or exceeds the longitudinal, a finding which is characteristic. Even though the incisura is filled out by the enlarged left auricular appendage and the pulmonary artery, it is partially restored by the dilated and hypertrophic left ventricle. This is especially true of mild or early cases. In old or advanced cases the incisura might be replaced by an outward convex shadow which is referred to the dilated pulmonary artery. Another quite characteristic finding is that the curve of the basal part of the left ventricle is more marked than it is in the apical part. In the second oblique view the silhouette is rounded because all the chambers are enlarged (Fig. 9).

COMBINED MITRAL STENOSIS AND INSUFFICIENCY

The silhouette varies according to the lesion predominating. Stenosis is especially indicated by a marked dilatation of the left atrium, a small left median distance, a long narrow heart and a well-marked third left arch. Predominating insufficiency is suggested by an increased left median distance, an outward convex shadow replacing the incisura, a rounded silhouette in the second oblique view (Fig. 9) and in those cases where the transverse diameter approaches or exceeds the longitudinal.

ASSOCIATED MITRAL AND AORTIC LESIONS

These combinations are common and various silhouettes are produced which are intermediary and which depend upon the predominating lesion. A mitral lesion gives a monotonous upright silhouette. To this is added the changes produced by the aortic lesion. Hence with an associated aortic insufficiency, as pointed out by Groedel, the heart is partially oblique due to the mitral lesion and presents a special projection to the left due to the aortic insufficiency, giving a "stair-step" left border (Fig. 10). If aortic stenosis is present it can usually be detected by the character of the pulsations.

Fig. 9. Mitral insufficiency in the second oblique view. The silhouette is rounded.

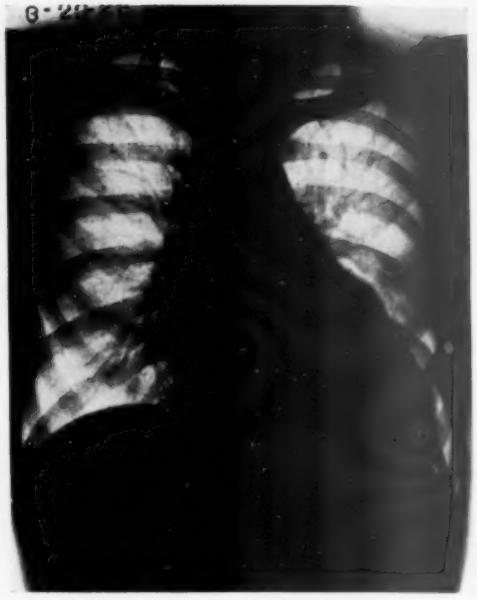

Fig. 10. Mitral stenosis and insufficiency and aortic insufficiency. The left atrium forms a separate arch (arrow) above the right atrium.

CONCLUSIONS

The roentgenological findings in lesions of the valves of the left heart produce rather definite silhouettes. In some lesions this silhouette is characteristic, but in every case the diagnosis should be made with this reservation—"provided the history and clinical findings favor, or at least do not oppose". However, the experienced roentgenologist should not hesitate to affirm his opinion, for many times when the clinical findings are confusing or suggest only one lesion, the roentgenological findings suggest a combined lesion.*

* For discussion see page 405.

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A CLINICAL AND ROENTGENOLOGICAL STUDY OF THE AORTA, WITH SPECIAL REFERENCE TO LUETIC AORTITIS*

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CONSIDERABLE divergence of opinion with regard to the aorta has existed between clinical observers and experimental workers. It is recognized that the size of the aorta in the living differs from measurements taken at the post-mortem table. The lack of direct measurements of the aorta in the living is partially responsible for these varied opinions. Even though it may be admitted that direct measurement of the aorta is impossible by roentgenological methods, it seems reasonable to attempt measurement of the supracardiac shadow as near the aorta as possible. Such an indirect estimation of the aortic width both in the normal and abnormal seems necessary in order to avoid errors in judgment, yet no diagnostic procedure can be sufficiently standardized to offset the necessity of experience. It is our purpose to present a series of cases representing normal and abnormal aortas studied by a method which we believe to be practical.

It was the practice at the Massachusetts General Hospital prior to 1926 to study the supracardiac shadow by a combination of posteroanterior teleroentgenograms and ordinary roentgenoscopy. The roentgenoscopy consisted of observations of the size, shape and pulsations of the upper mediastinal shadows in various views together with tracings both in the posteroanterior and first or right oblique positions. The usual type of roentgenoscope was used with a target screen distance of about 25 inches and the films were taken at a 7 foot target film distance. No attempt was made to separate the supracardiac shadow into its component parts in either view.

The roentgenoscopic tracings in the posteroanterior position were as true as possible and usually followed the external border of the aortic pulsations insofar as they could be seen. The patient was then rotated towards the right so that the right nipple approximated the center of the screen and the sagittal plane of the patient was at an angle of from 30° to 45° with the central beam from the tube. The correct position in this maneuver is actually obtained not by measurements in degrees but by observing the supracardiac shadow as the patient is rotated towards the right till the position is such that the ascending and descending aorta near the arch seem to superimpose, or in other words, the position is considered correct when the ascending and descending aorta approximates the shadow of the vertebrae and are in their narrowest projection. A tracing is then made to outline the anterior border of the dorsal vertebrae and the total supracardiac and cardiac silhouette as originally described by Holzknecht[4] in 1900.

An interpretation of the supracardiac shadows thus obtained by teleroentgenogram and tracings consists principally in deductions depending upon the following:

(a) Observations of the heart shadow as to size and shape (Holmes and Ruggles[3]; Ledbetter, Holmes and White[5]; Martin[6]).

(b) Measurement of the total supracardiac shadow at its widest point above the region of the pulmonary conus, and if the total exceeds 6 cm. and is not explicable by tortuosity of the aorta, obesity, high diaphragm or a mediastinal mass, the aorta is thought to be dilated.

* From the X-Ray and Cardiac Laboratories of the Massachusetts General Hospital, Boston, Mass. Read at the Thirtieth Annual Meeting, American Roentgen Ray Society, New York City, Sept. 17–20, 1929.

(c) Review of notes made during roentgenoscopy as to pulsations, size and shape of the aortic region.

(d) Comparison of the tracings, i.e., if the oblique tracing is not noticeably smaller than the posteroanterior or if it does not appear as a narrow truncated cone which will not superimpose upon the posteroanterior tracing, the aorta is thought to be dilated.

The errors in the above method are numerous and the accuracy of the deductions are in direct proportion to the experience of the observer. It is remarkable how accurate the experienced have been and it is for this reason that we hesitate to criticize the method. The sources of error may be briefly tabulated:

(*a*) Inability to determine a site of measurement of the posteroanterior projection which is consistent.

(*b*) Inability to superimpose the aorta on anatomical grounds, since the aorta in most instances deviates from a single plane.

(*c*) Error in degrees of rotation, since the narrowest supracardiac silhouette, according to Frik,[2] is obtained when the patient is rotated to 30°, in which position the aorta is partially obscured by the vertebral shadows.

(*d*) Confusion in differentiating the posterior mediastinum or space of Holzknecht from the similarly radiant trachea and main bronchi.

(*e*) Haziness of the posterior mediastinum due to superimposed hilus and pulmonary vessel shadows.

In view of the above possibilities of error and in order to facilitate more accurate tracings and more perfect posing of the patient for the teleroentgenograms in various positions, it was thought desirable to install a roentgenoscope suitable for examinations at a 7 foot tube-screen distance. Such an apparatus was reconstructed in 1926 from an old Snook roentgenoscope. Since that time 7 foot films have been taken with considerably more ease and accuracy of position though the fluorescent light is not so good as that obtained at 25 inches. Adequate protection is obtained by lead diaphragms limiting tube rays to the size of the roentgenoscopic screen. It was found impracticable to utilize the diaphragm shutters in the study of local areas but the tube position can be controlled with ease. The cases here presented have been studied with this apparatus, and the possibility of accurate positions, together with the suggestions made in recent literature, has encouraged more detailed studies of the heart and aorta in the oblique views. Since 1926 many heart studies have consisted of both right and left oblique teleroentgenograms and 7 foot tracings. The information obtained from the second oblique position seems most encouraging and it is with this view that we are primarily concerned.

Under direct roentgenoscopic observation the second or left oblique position of the patient can be obtained with little difficulty. The patient is simply rotated to the left with the left nipple approximately in the center of the back of the roentgenoscopic screen until the bright space behind the ascending aorta and below the aortic arch is most clearly seen. The right arm is then brought forward over the top of the screen. The examiner grasps the extended right wrist of the patient as it extends toward him and rotates the arm medially as it is pulled upward and forward. This maneuver results in drawing the scapula forward and upward and causes the right intercostal spaces to widen, thus giving the maximum clarity of vision of the aorta insofar as it is visible. One is particularly impressed with the clear bright space behind the region of the ascending aorta and below the aortic arch which we have pleased to call the aortic window. In the cases of arteriosclerosis observed, the aorta appears visible and the aortic window is obviously not far removed from the posterior limit of the ascending aorta, while the anterior limit of the aorta seems quite clearly defined against the bright space of

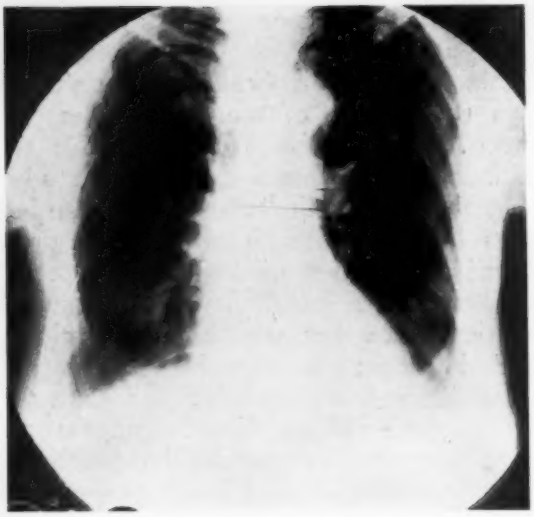

Fig. 1. Arteriosclerotic aorta. Posteroanterior view.

the right lung. The course of the normal aorta is traced with more difficulty, yet it is believed that the aortic window and the anterior border of the ascending aorta can be easily identified, and since this, the apparent anatomical location of the clinically important ascending aorta, can be localized it is thought practical to try to measure it.

The two points selected are anterior and posterior; the anterior being at the junction of the upper and lower arcs seen clearly outlined against the radiant right lung, the upper arc probably representing the ascending aorta and the lower the right auricle; the posterior is selected by following the short visible portion of the ascending aorta in the region of the aortic arch downward to its intersection with the faintly defined heart silhouette. This posterior point is (although sometimes difficult to locate) thought to be in the anatomical location of the left branches of the pulmonary artery and is usually seen to be on a line approximately in the central axis of the trachea and about 2 cm. below the apex of the angle formed by two main bronchi at the bifurcation of the trachea. In some cases a radiant angle is seen at this point but in most instances the point is dense and irregular, probably representing branches of the pulmonary artery. Measurements taken from these two points have been tabulated and compared with the method of Reich[7] and Assmann,[1] together with the total supracardiac dullness measured in the posteroanterior teleroentgenogram.

The method of Reich is briefly as follows: The anterior point of measurement is selected slightly above the junction of what appears to be the ascending aorta and right auricle at the level of the termination of the right main bronchus. A horizontal line connects this anterior point with the line of the anterior wall of the right main bronchus. According to Assmann this measurement reveals a normal average of about 4.5 cm., but Assmann intimates that such a standard should not be accepted until a large number of normals have been measured and he also claims that the measurements are difficult due to the confusing shadows of the sternum superimposing upon the radiant right main bronchus. In the cases we have measured by this method a wide variation in the normal and abnormal has been noted. It seems more accurate to select a point for the posterior limit of measurement which is nearer the

Fig. 2. Right anterior-oblique view. Showing visibility of arteriosclerotic aorta.

central axis of the thorax and the sagittal plane of the aorta. The variations from the normal established by Assmann may in part be due to errors in position of the patient since we made no attempt to place the patient at a specified angle with the central beam of the tube. The measurements made in a selected group may be briefly tabulated as follows:

Aortic Measurements

	29 Leutic Cases Aortic Dilatation Average	*17 Arteriosclerotic Cases No Dilatation* Average
Reich (Assmann)	5.1 cm.	4.2 cm.
Ascending aorta	7.8 cm.	5.6 cm.
Arch	4.2 cm.	3.5 cm.
Anteroposterior	7.0 cm.	6.2 cm.

It is noted from the above table that the Reich[7] measurement is above the suggested normal, and that the average Reich measurement of the arteriosclerotic aorta is below the normal suggested by Assmann[1] but the difference between the normal and abnormal is only 1.1 cm. (It is further noted in a review of the complete table of measurements that the high and low limits of the dilated aorta measurements after the method of Reich are considerably wider.)

In the second line of the table marked "ascending aorta" we present the average measurement of the dilated aorta and the average of the arteriosclerotic aorta. It is here noted that the difference between the sclerotic and dilated aorta of lues amounts to 2.2 cm., suggesting a greater margin of differences than that found in the Reich measurement.

Fig. 3. Luetic heart diease. Posteroanterior teleroentgenogram.

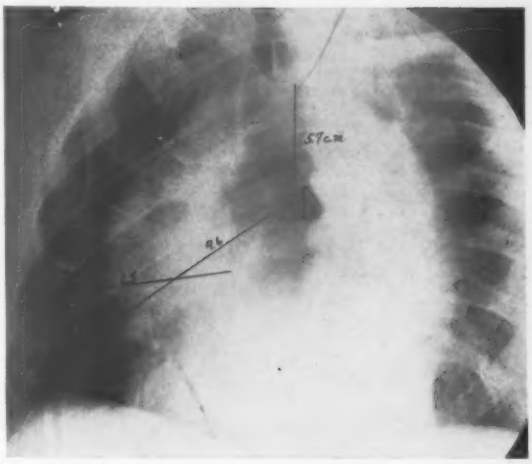

Fig. 4. Dilatation of aorta in luetic aortitis. Left anterior-oblique position with typical measurements.

It is further interesting to note from the table that the anteroposterior and arch measurements in the group of dilated aortas are greater than the accepted normal, viz., 6.0 cm. and 3.5 cm. respectively.

The material chosen consists of 120 cases which have been studied roentgenologically as outlined above. The far greater number of cases was obtained by including those patients seen in the cardiac clinic, out-patient department, or on the wards of the Massachusetts General Hospital, in the past two years, with a clinical impression of luetic disease of the aorta, and on whom roentgen studies had been made or could be made in the past several months. This selection resulted in 84 cases; 19 other cases were chosen because of the roentgen finding of aortic dilatation and the remaining 17 cases, chiefly arteriosclerotic, because there was no aortic dilatation. The total number of cases found by roentgen examination to have aortic dilatation was 86 out

of the 120 cases, while those without dilatation totaled 34.

Of the 86 cases exhibiting dilatation of the aorta by roentgen examination, 67 must be considered luetic in origin, having been found to present the syndrome of luetic aortic disease. The more important data concerning the remaining 19 cases may be summarized as follows:

Non-Luetic Aortic Dilatation (19)

Hypertension (19) Sys. B.P. 150–170.....6; 170–190.....4; 190+.....9

Positive Wassermann.....4

Aortic regurgitation.....7

Clinical Diagnosis

Hypertension.....5

Hypertension and arteriosclerosis.....12

Rheumatism and hypertension.....2

The cases chosen at random, because of aortic dilatation by roentgen examination, all were found to have hypertension. Thirteen of the cases had systolic blood pressure above 170. It is evident from such findings that hypertension, *per se*, a common roentgen finding in cases with aortic dilatation, adds much difficulty where a differential diagnosis is necessary. Aortic regurgitation was present in 7 cases, and 4 had positive Wassermann reactions. Only one case had aortic regurgitation, a positive Wassermann reaction and hypertension, the usual luetic syndrome clinically. This patient gave a frank rheumatic history. In 3 of the cases there was a question of luetic aortic disease, but this impression was secondary to hypertension and arteriosclerosis.

Luetic Group. This series consists of 84 cases studied because of the clinical diagnosis. In 67, or 79.8 per cent, of the cases definite aortic dilatation was found by roentgen examination, and this is called the diagnostic agreement group. The remaining 17 cases, or 20.2 per cent, were considered to have aortic shadows within normal limits. The outstanding clinical findings may be summarized by the following tables:

Aortic Dilatation by X-Ray—Clinically Luetic—67

Aneurysms.....12

Wassermann positive.....49

Normal blood pressure.....35

Hypertension.....32 150–170...15; 170–190....8; 190+....9

Aortic Regurgitation—44

1. 20 with positive Wassermann and hypertension
2. 13 with positive Wassermann and normal pressure
3. 6 with negative Wassermann and hypertension
4. 5 with negative Wassermann and normal pressure

No Aortic Dilatation by X-Ray Clinically Luetic—17

Aortic regurgitation.....14

Wassermann positive.....16

Hypertension.....11 150–170....6; 170–190....4; 200+....1

Wassermann positive, hypertension and aortic regurgitation.....9

Subacute bacterial endocarditis.....1

The percentage of cases in the group with diagnostic agreement between the clinical and roentgenologic studies, showing a positive Wassermann reaction, aortic regurgitation and hypertension is striking. The Wassermann reaction is positive in about three-fourths of the cases, aortic regurgitation in almost three-fourths, and hypertension in about one-half.

Sixteen of the 17 cases considered as having luetic disease of the aorta clinically, without confirmatory roentgen evidence, had positive Wassermann reactions, 14 had aortic regurgitation, and 11 had hypertension; 9, over one-half, had positive Wassermann reactions, aortic regurgitation, and hypertension. One interesting case was diagnosed clinically as having subacute bacterial endocarditis with luetic aortitis as a background. Lack of aortic dilatation by roentgen examination was contrary to this opinion. The absence of the finding of aortic dilatation in these cases is extremely important. While we do not suppose that it is impossible for an aorta to be visible within normal limits,

and at the same time have luetic disease, yet the percentage of agreement (79.8 per cent) is encouraging, even should a portion of the remaining group ultimately exhibit aortic dilatation by roentgen examination or have luetic disease proved by autopsy.

Of the series of 34 cases included in our study of the aorta, the measurements of which would appear to be within normal limits, 17 were arteriosclerotic, and 17 composed the disagreement portion of the luetic group. The latter have been summarized previously. In the 17 arteriosclerotic cases there were 6 with hypertension; 3 with systolic blood pressure between 150 and 170; and 3 above 170. Only one case had aortic regurgitation, and 3 had positive Wassermann reactions. There was no variation between the aortic measurements of the arteriosclerotic cases and those clinically considered as luetic, but lacking roentgenologic confirmation. The age groups were as follows: 5 under forty years; 24 between forty and sixty years; and 5 over sixty years. The group is consequently well above early adult life, or better, it is comparable to luetic aortic disease age.

SUMMARY

1. The method of study of the aorta now in use at the Massachusetts General Hospital is presented.

2. This method, we believe, is valuable in determining the presence or absence of aortic dilatation.

3. Roentgenoscopy at a 7 foot tube-screen distance is considered a valuable adjunct to accurate positions for the teleroentgenogram.

4. Teleroentgenography in the left or second oblique position has been found to give valuable evidence of aortic dimensions.

5. The points of measurement selected are described, and are thought to be of practical application.

6. Measurements of the aorta in cases thought to have sufficient clinical and roentgenologic basis for dilatation, compared with those measurements of arteriosclerotic aortas, seem to justify the deduction of a normal and abnormal average. The arteriosclerotic ascending aorta was found to average 5.6 cm., while the dilated aorta group averages 7.8 cm.

7. Arteriosclerosis usually renders the aorta measurable.

8. The roentgenological and important clinical findings in 120 cases are presented.

9. There was agreement clinically and roentgenologically in 79.8 per cent of the luetic group.

10. The differential diagnosis in cases found by roentgen examination to have aortic dilatation depends upon clinical and other roentgen findings.*

* For discussion see page 405.

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THE VALUE OF ROENTGENOLOGIC STUDY OF THE ESOPHAGUS AND BRONCHI IN CASES OF HEART DISEASE, ESPECIALLY MITRAL DISEASE*

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THE value of roentgenology of the heart has always been debatable. For the average observer the criteria of differential diagnosis have never been sufficiently clearly defined, though there have been those whose knowledge of cardiac roentgenography, founded on considerable experience, has been both accurate and valuable. Recently, however, there have been attempts to define more sharply the dominant features of various types of heart disease, as the work of Steel,[4] Rigler,[3] Wheeler,[10] and others, would indicate. The effort is directed not so much towards adding to the numerous methods of clinical approach to the solution of heart problems, but towards establishing the roentgen diagnosis on a sufficiently firm footing to be able to make a complete diagnosis independently, yet with sufficient certainty, and thus to afford corroborative evidence of the clinical diagnosis. Some of the recent work merely stresses the salient features of altered heart contour as already worked out by Vaquez and Bordet,[9] and others of the older masters of cardiac roentgenography.

More recent work, however, attempts to establish new methods of approach to the problem. The first of these depends on the fact that the bronchi, especially the left bronchus, bear a relation to the upper border of the heart, and may become deformed in certain types of heart disease. This was not stressed as of clinical significance until it was pointed out by Steele and myself,[5] though purely academic references had been made to it. The differential diagnostic value of this point is one which I would like to emphasize.

Secondly, Rigler[3] has shown that by using the esophagus to map out the mediastinum, an extremely accurate conception of the pathological conditions of the horizontal and descending aorta can be obtained. He points out that the posterior surface of the esophagus maintains an intimate relationship to the anterior surface of the aorta. This author and several other writers have emphasized the value of esophageal mapping as an indication of the size of the auricle in mitral disease.

I believe that by taking note of both esophagus and trachea, it is possible to differentiate active mitral disease from other forms of heart disease with more certainty than by study of roentgenograms made in the ordinary anteroposterior and oblique positions, or even by the most elaborate system of correlated measurements. Patients with mitral disease, whether stenosis or incompetence, sufficiently advanced to give symptoms show evidence of some degree of cardiac enlargement and evidence of relative enlargement of the left auricle as shown by one, or all, of the following signs: some protrusion of the shadow of the left auricle beyond the right border of the heart, deviation of the esophagus to the right and backward (or rarely, to the left and back), and deviation of the left bronchus upward. These signs are not found in other types of enlarged heart.

Alteration of the heart contour may not be present when the only evidence of disease is the mitral murmur, i.e., in completely compensated, healed cases. A series of cases was studied in which the presence of a presystolic murmur was discovered and a

* Read at the Thirtieth Annual Meeting, American Roentgen Ray Society, New York City, Sept. 17–20, 1929.

history of previous rheumatic fever obtained during routine examination, but in which there was absolutely no evidence of heart embarrassment. In those cases no alteration of heart contour was noted roentgenologically.

No complete roentgenologic evaluation of heart conditions can be made from films alone—even with oblique and lateral views. Roentgenoscopic examination is necessary to determine the pulsation of the various chambers and the interrelationship of such pulsations. There are many ways of suitably carrying out an examination without undue extravagance in films. The following is offered merely as a suggestion. The patient should be examined under the roentgenoscope in all positions by rotating him slowly; an idea of the contour and of the relative size of the various chambers is thus obtained; as far as possible, the time relations of the auricular, ventricular and aortic pulsations are determined. Then the esophagus should be examined in the anteroposterior, both anterior-oblique positions and laterally. The patient is given a moderately thin barium mixture through a drinking tube or straw and asked to keep on drinking this as fast as possible. Ordinarily a true picture of the esophagus is not obtained if a solid or semi-solid mixture is used as when examining for obstruction. Using fluid the whole esophagus fills naturally and any impressed pulsations from the back of the heart or the front of the aorta are observed, and any deforming masses in the mediastinum are noted. Following the roentgenoscopic examination a single posteroanterior teleroentgenogram, using flash technique, and a single lateral roentgenogram are taken while the patient is actually drinking this fluid barium mixture. If able to do so, the patient sits up, and the question of breathing is not considered, as it automatically assumes a mean position between inspiration and expiration. In addition, localized roentgenograms of the area occupied by the bronchial angle of the trachea are taken in the posteroanterior and the left anterior-oblique positions. If the aorta is also being studied, a complete left anterior-oblique view should be taken. The bronchi are not always successfully visualized in stout patients; in certain cases the injection of a little lipiodol by some simple method, in order to visualize the bronchial angle, is justifiable. Details of the successful use of this method in such a case have already been reported.[5]

The first consideration is the size and contour of the heart. Roentgenologically the degree of enlargement of a heart may be estimated in several ways. An estimation on sight of the heart size, based on experience, taking cognizance of the patient's build and type, is probably fully as valuable as more technical methods. The common rule of thumb that in the normal heart the transverse diameter should not exceed one-half the internal transverse thoracic diameter has been shown by Karshner and Kennicott[2] to be "grossly inaccurate." Van Zwaluwenburg's method[8] of calculation by comparing the P.O.D. (product of the long and short diameters) with a known normal for the weight of the patient, is simple and sufficiently accurate. Hodges and Eyster[1] have made valuable tables for the normal heart by evaluation of the area of the heart shadow as seen in posteroanterior orthodiagrams. Although it is believed by some that a teleroentgenogram is not so accurate as an orthodiagram, yet the consensus of opinion seems to be that, if correctly taken, it is accurate enough for the purpose and much easier to obtain. These authors point out that hearts more than 7 sq. cm. above normal have a 3 to 1 chance, those over 14 sq. cm. a 10 to 1 chance of being pathological—a very useful guide. I know of no computations showing what percentage of pathological hearts show enlargement, but experience indicates that very few diseased hearts with active symptoms remain of normal size.

The so-called "mitral" shape of heart in which the upper transverse diameter is increased and the pulmonary and

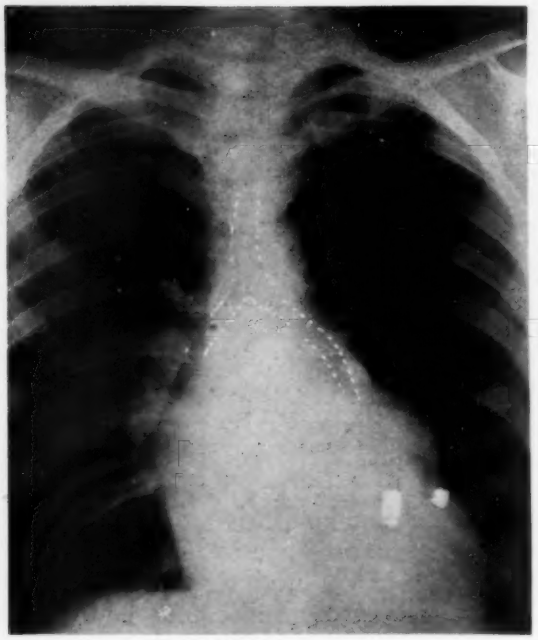

Fig. 1. Posteroanterior roentgenogram of the thorax, showing the typical "mitral" configuration of the heart, some evidence of the border of the left auricle beyond the normal right border of the heart and distortion and deviation of the left bronchus (the latter artificially outlined but quite visible in the original film). The films were taken during an acute recurrent attack of rheumatic fever with the patient actually decompensated.

Fig. 2. Posteroanterior roentgenogram of the heart only, showing projection of the shadow of the left auricle to the right to a marked extent and enormous widening of the tracheobronchial angle. The patient gave a history of thirty years' recurrent attacks of heart failure, commencing with rheumatic fever, had an enormous heart, and clear-cut clinical evidence of mitral stenosis and incompetence. The auricle was fibrillating (checked by electrocardiogram).

auricular curves on the left emphasized (Fig. 1) is well known, is always suggestive of mitral disease, and invites further investigation. In both stenosis and incompetence there is some relative enlargement of the left auricle if the heart is actually embarrassed even to a minor degree. Steel,[4] in his excellent article on the mitral heart, has emphasized this constant auricular dilatation. Most of the signs to be described depend upon this fact. In the rare cases of uncomplicated stenosis, the left ventricle does not enlarge.

The left auricle lies not to the left, but directly posterior, occupying the base of the heart, and any enlargement can be appreciated in either left or right anterior-oblique roentgenograms as a protrusion of the upper portion of the back of the heart into the posterior mediastinal space. Steel states that there is a relative enlargement of the right ventricle as well, caused by back pressure through the lungs; this is especially noticeable in cases predominantly stenotic. This right ventricular enlargement rotates the heart towards the left, bringing the posteriorly dilated auricle to the right; the shadow of the right border of the left auricle then shows as an additional abnormal curve on the right border of the heart shadow in the posteroanterior view (Figs. 1 and 2).

The next consideration is the position of the esophagus. The use of barium in the esophagus to outline the posterior border of the heart and the anterior border of the thoracic aorta is not new, but until recently

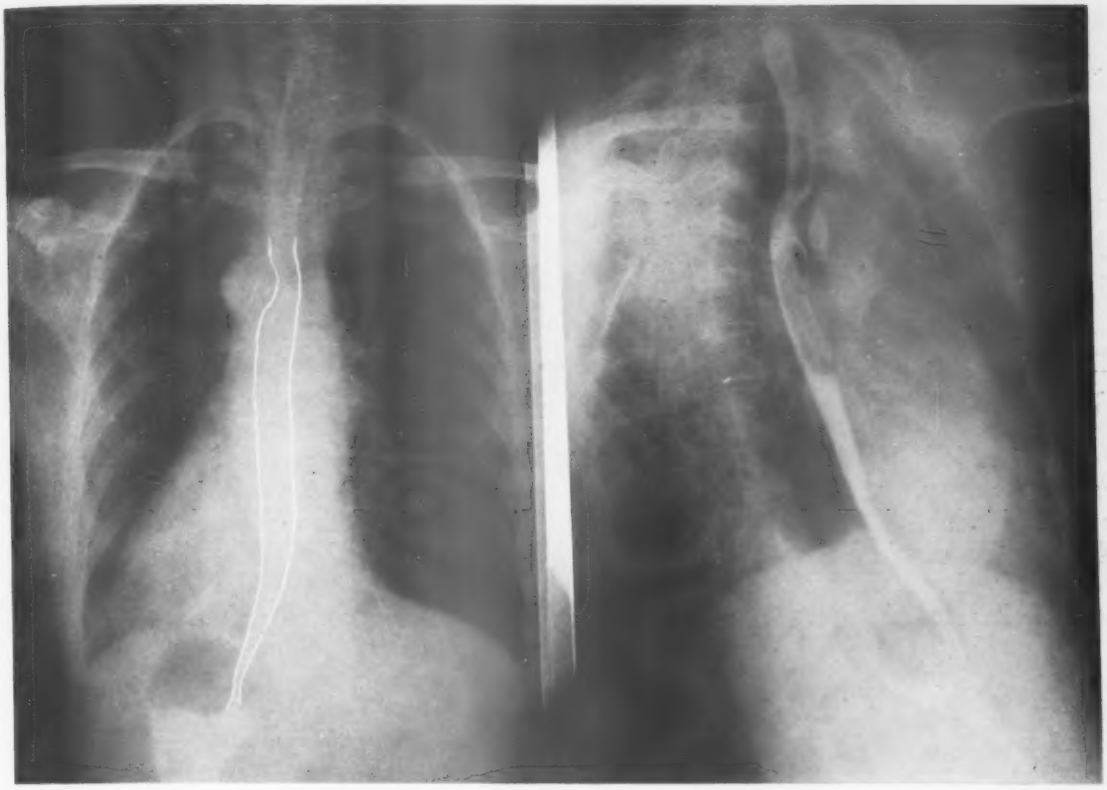

Fig. 3. Posteroanterior and right anterior-oblique roentgenograms showing the normal position and contour of the esophagus.

has been of little but academic interest. Actually the method appears to me to offer unusual possibilities as a routine method of determining alterations in the contour of the posterior border of the heart and to be more accurate than a study of films in the oblique position.

The normal esophagus, examined by fluid barium, as seen in the posteroanterior position, is a wide tube traversing the midthoracic line, showing clearly on its left the indentation of the horizontal arch of the aorta. Just above the diaphragm the esophagus passes to the left to the esophageal hiatus of the diaphragm. Normally, as observed laterally or in the right anterior-oblique position it closely follows the curve of the front of the spine without particular indentations (Fig. 3).

In cases of mitral disease the combined posterior dilatation and right rotation of the auricle is evidenced and mirrored accurately by the resultant deformity of the esophagus. The auricle occupies about the middle third of the posterior part of the heart, and in this segment is in direct contact with the anterior surface of the esophagus. As the auricle enlarges the esophagus rides up on the dilated chamber and shows a definite, smoothly curved displacement and compression (Fig. 4) in which the pulsation of the auricle may be clearly seen. Essentially this displacement is backwards, but, possibly owing to the resistance offered by the central mass of the spine, the esophagus practically always passes to one side or the other; usually it passes to the right (Fig. 5) presumably as a result of the rotation already mentioned, but occasionally it passes to the left (Fig. 6). I have also seen it remain directly posterior and be compressed up against the spine in a

Fig. 4. Lateral roentgenogram of the esophagus showing the backward displacement which results from enlargement of the left auricle. This was a clinically definite case of mitral stenosis and incompetence—predominantly incompetence—of five years' duration. The auricle was fibrillating (checked by electrocardiogram).

case with an enormous left auricle (Fig. 7).

The last consideration is of the deviation of the trachea. The bronchial angle at the bifurcation of the trachea in the normal individual has been shown by Stoerk,[7] from anatomical studies, to vary from 58° to 78°; I have elsewhere[6] shown that the normal, from a roentgenologic point of view, varies from 40° to 70°. The average angle was 58° and the maximum angle, even in stout individuals, did not exceed 70°. The right bronchus makes a very small angle with the trachea; the left bronchus turns off at an acute angle and passes in a straight line towards the left hilus, passing under the aortic arch. It may turn slightly upwards or downwards just before dividing into its pulmonary branches. The left bronchus is more easily visualized in roentgenograms taken in the left oblique position (Fig. 8); the angle is reduced, on the average, by an apparent 10° but the general contour is maintained, and any alterations perfectly evident. This angle and this contour give important information regarding the contour of the upper portion of the base of the heart.

Normally there is a small space between the left bronchus as it passes under the aortic arch and the upper surface of the auricle at the base of the heart. With auricular enlargement this space is eliminated, and the left bronchus rides on the auricle. With further enlargement, the bronchus is pressed upward about its middle, where it passes free of the under surface of the aorta. This causes two changes: the bronchus is elevated as a whole, widening the bronchial angle, and is distorted in that its normal straight contour develops an upward convex curve in the middle third (Figs. 1, 2 and 9). The bronchial angle may become 90° or more; in no case of well-developed mitral disease was it found to be less than 70° (the upper limits of normal) (Fig. 10). Stoerk,[7] in the previously mentioned anatomical studies, showed it to vary from 78° to 117° in cases of mitral disease. Clinically this is usually of no importance, although it has caused symptoms due to bronchial stenosis, but it is a valuable diagnostic point.

In the majority of cases of mitral disease the presence of fibrillation of the auricle can be appreciated roentgenologically. One has, of course, the same clue as the clinician, in that the heart is beating irregularly. With this clue the presence or absence of auricular pulsation transmitted to the column of fluid barium in the esophagus should be sought. Two alterations indicate fibrillation in the presence of heart irregularity. One is the complete absence of pulsation transmitted to the esophagus. The other alteration is that occurring with incompetence or with the more common double lesion. The non-pulsatile auricle registers the pulsation of the ventricle, presumably as the result

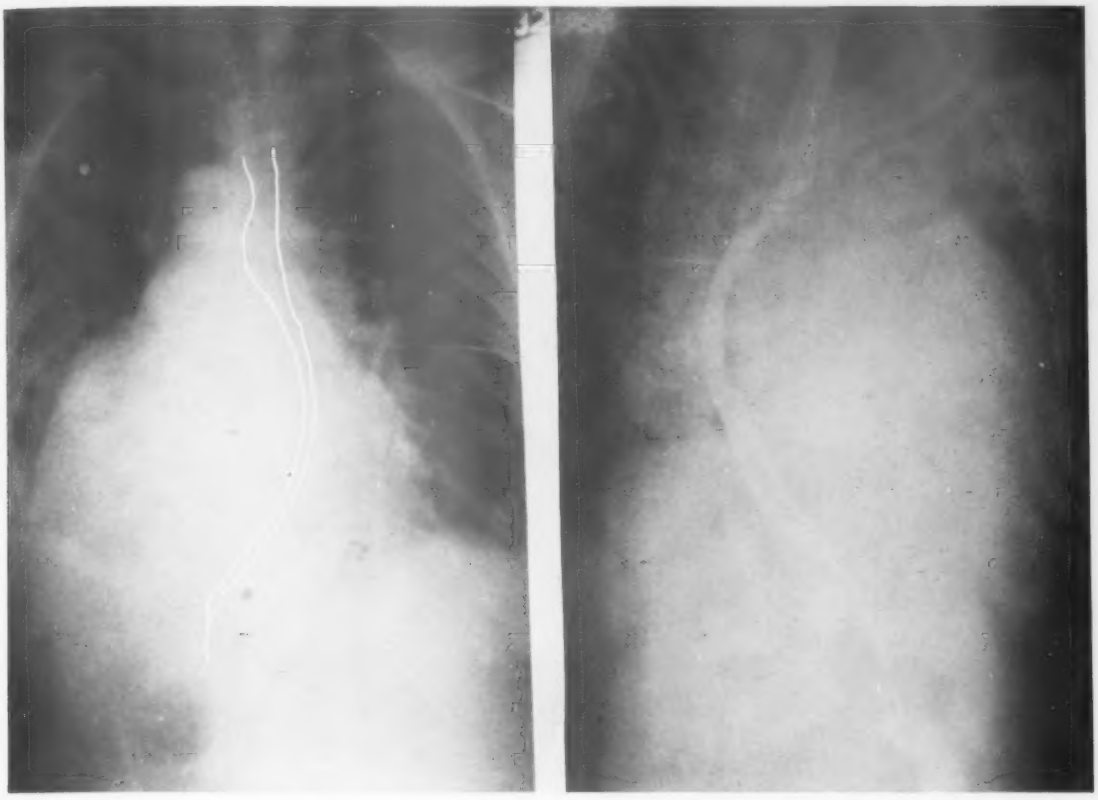

Fig. 5. Posteroanterior and right anterior-oblique roentgenograms showing the esophagus displaced backwards and to the right and therefore showing the maximum evidence of deviation in the right oblique view. This was a case showing evidence of mitral inconpetence with a history of three years' duration. The auricle was fibrillating.

of ballooning by regurgitant flow. This may be recognized because the auricular pulsation shown in the barium column does not precede, but follows upon ventricular pulsation and is synchronous with the transmitted pulsation of the aortic and pulmonary cone. Where there is evidence of projection of the left auricle beyond the right heart border a very obvious double pulsation on the right border results. The upper pulse occurs during the influx of blood through the incompetent valve into the left auricle, while the lower pulse is that of the inert right auricle which merely rides on the right ventricle. This gives a distinct see-saw effect on the right border and is pathognomonic of auricular fibrillation in a heart with an incompetent mitral valve.

The complete absence of all these criteria is strong evidence of the absence of active mitral disease; it is rare to find clear-cut, clinical, mitral disease which fails to show these signs of auricular enlargement. The question arises however, whether these effects are not those due to enlargement of the heart as such and not specifically those due to a relatively enlarged auricle To investigate this, a number of cases in which the heart was markedly enlarged from other causes were studied. These included enlargements due to strictly aortic valvular lesions; to hypertension both benign and malignant; to toxic hearts such as post-influenzal myocarditis; to the toxic heart of hyperthyroidism (the so-called "goiter heart"); to congenital heart disease, and to pericardial effusion. In all of these the en-

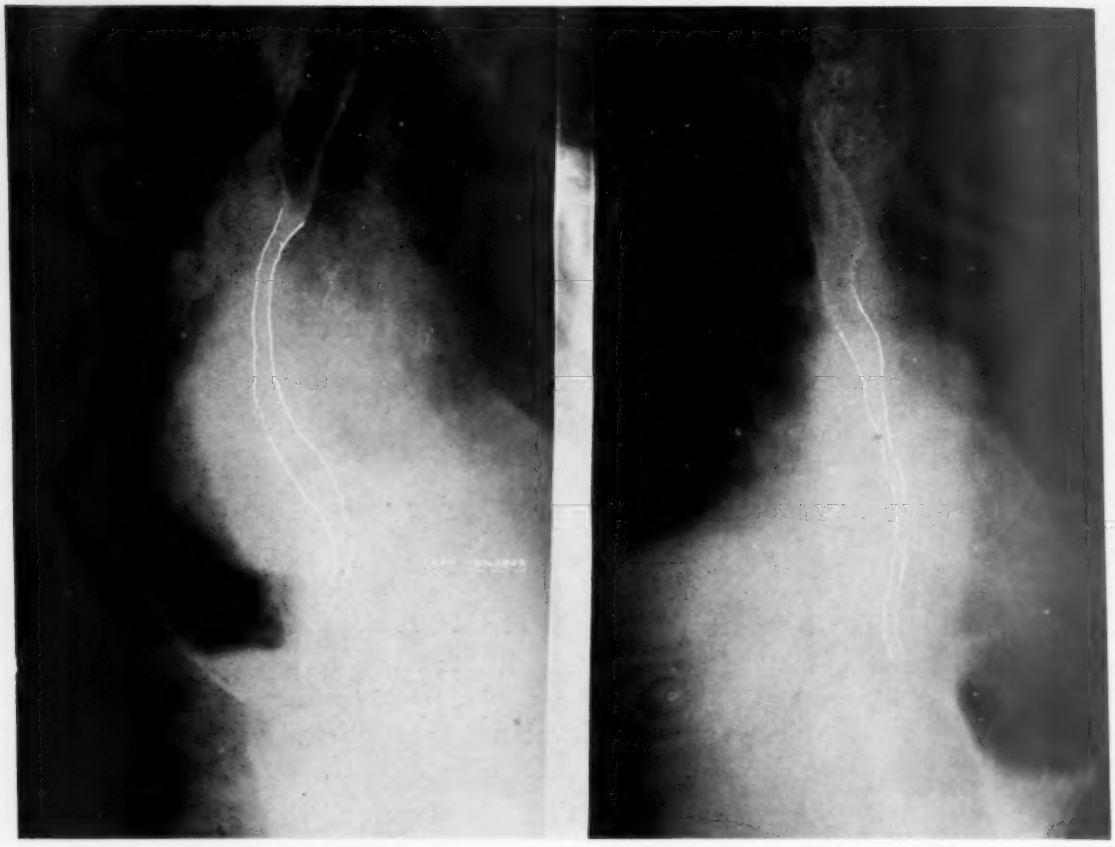

Fig. 6. Left oblique and posteroanterior roentgenograms showing the rare deviation of the esophagus to the left and backwards, and therefore giving the maximum evidence of deviation in the left oblique view. The patient gave a history of heart trouble of twenty-five years' duration, commencing with rheumatic fever and showed clinical evidence of mitral incompetence. She also had a large goiter (note the deviation of the esophagus in the neck), but this was definitely non-toxic.

largement of the heart was Grade III to IV on a scale of IV, yet there was never any evidence of duplicated right border or of tracheal deviation (Fig. 8). In some cases there was a suggestion of posterior deviation of the esophagus; this was never of the localized nature discussed here, but was rather a general backward deviation of the whole length; even so, it never occurred to the same extent relative to the heart size as it did in cases of mitral disease. What did occur was perhaps due to functional incompetence arising from carditis with dilatation, for it was not seen at all in congenital hearts even when enormous. The maintenance of the bronchial angle was the more striking because in these films the whole bifurcation lay directly behind the enlarged heart (Fig. 8) and contrasted noticeably with the upward riding of the bronchus in mitral hearts.

Two cases (both at first clinically suspected to be mitral cases) afforded an interesting commentary on this method. In one case the heart showed none of the above criteria of mitral trouble roentgenoscopically, and proved almost certainly an initial attack of acute rheumatic carditis without any persisting valvular signs. The other was diagnosed roentgenoscopically as having some degree of tracheal and esophageal deviation, but not in proportion to the enlargement of the heart. It was suggested that, contrary to the first clinical impres-

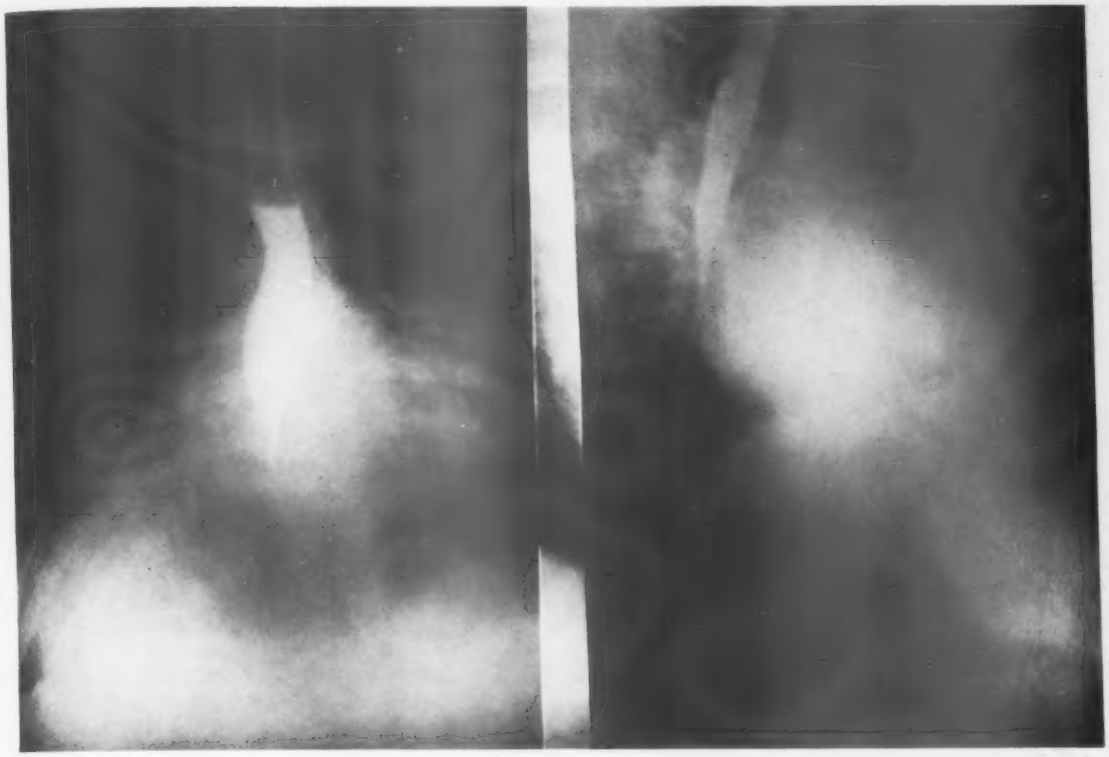

Fig. 7. Posteroanterior and lateral roentgenograms of the esophagus showing a displacement directly backwards, with resultant compression of the esophagus against the spine. Same case as shown in Figure 2. This patient also had clinical evidence suggesting lymphatic duct obstruction—possibly by the enlarged auricle.

sion, from the roentgenologic point of view, this was not a true chronic mitral heart. The case was ultimately diagnosed clinically as one of subacute bacterial endocarditis of recent origin, with involvement of the mitral valve; the diminished degree of deviation was due to the fact that the lesion of the mitral valve had been effective for a short time only.

These disturbances of the posterior mediastinum by an enlarged left auricle are interesting not only from a differential diagnostic point of view, but from a clinical point of view, in that their demonstration roentgenologically may help, in individual cases, to explain symptoms not otherwise properly understood. The esophageal compression may be evidenced by dysphagia. I have stressed particularly the deviation and distortion of the bronchus because of its significance in the diagnosis of mitral disease, but there is no doubt that the resultant compression may give signs on physical examination, or may result in symptoms very much resembling bronchiectasis. In one interesting case observed the auricle was enormous and completely obliterated the esophagus from before backwards. There was also complete lymphatic duct obstruction in the thorax as evidenced by recurrent ascites and marked edema confined to the lower half of the body. It is possible that this also arose through pressure on the duct by the auricle.

SUMMARY

Roentgenoscopic examination in cases suggestive of mitral disease is incomplete unless the contour of the esophagus, as outlined by barium, is observed, and special

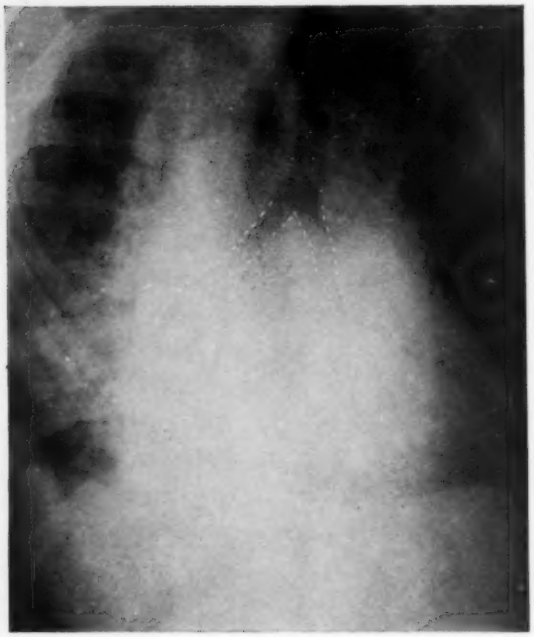

Fig. 8. Left anterior-oblique roentgenogram of the chest showing a normal tracheobronchial angle as visualized in that position. This shows maintenance of the normal in a case with a very large heart from a cause other than mitral disease (post-influenzal myocarditis).

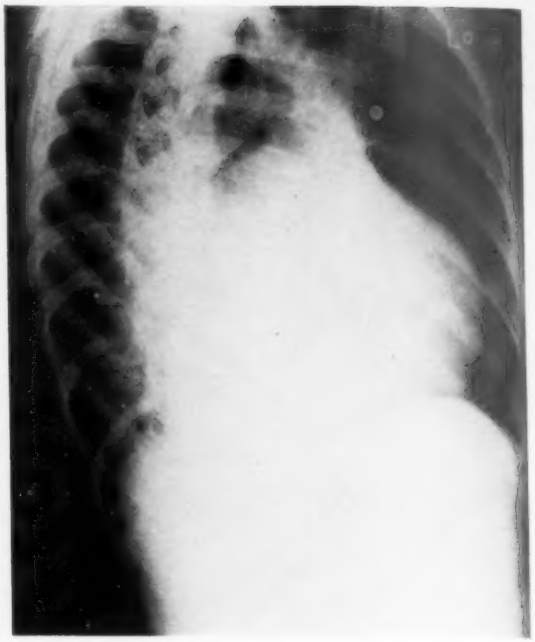

Fig. 9. Left anterior-oblique roentgenogram of the chest showing widening of the tracheobronchial angle and compression of the left bronchus produced by an enlarged auricle. This shows how the left oblique position brings out the bronchial angle clearly. Same case as shown in Figure 4.

roentgenograms are taken of the bronchi at the bronchial angle. This gives definite information regarding the contour of the posterior and upper borders of the heart, which cannot be obtained with as great certainty by oblique and lateral views only.

Patients with mitral disease sufficiently advanced to give symptoms show evidence

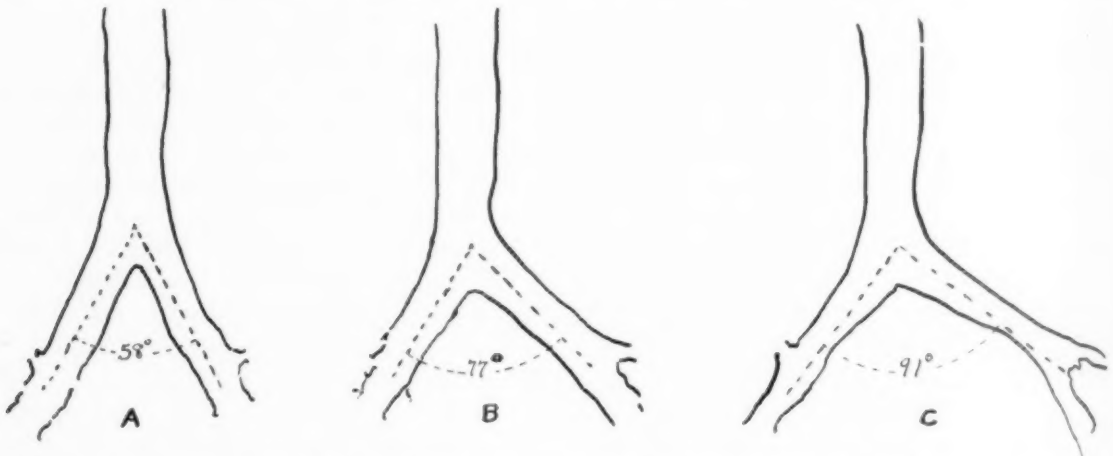

Fig. 10. Diagram showing the tracheobronchial angle and the conformation of the left bronchus in (*A*) an average normal heart; (*B*) a very large heart (pericarditis) not due to mitral disease, and (*C*) a case of combined mitral stenosis and incompetence.

of some degree of enlargement of the heart and evince one, or all, of the following signs: some protrusion of the left auricular shadow beyond the right border of the heart; deviation of the esophagus to the right and backwards (or rarely, to the left and back); and deviation of the left bronchus upwards. These signs are not found in other types of enlarged heart.

Fibrillation in such hearts can sometimes be determined by roentgen examination independently of other methods.

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DISCUSSION OF PAPERS BY DRS. WHITE; DANN; O'KANE, ANDREW AND WARREN; STEEL; HAMPTON AND JONES, AND PATERSON

Dr. A. W. Crane, Kalamazoo, Mich. It is a matter of very great interest to get up to date on roentgenology of the heart. Just recently a revision of the Oxford Medicine has been published. Previously Sir James MacKenzie had written on the heart. This time we have the heart handled by one whom we all agree is one of the leading clinicians of the world, Dr. Henry A. Christian. The importance of this work lies in the fact that he discusses the value of the x-ray from the standpoint of a clinician. We have been working on the roentgenology of the heart for some thirty years. It is quite evident from reading Christian that he has really very little use for the roentgen examination of the heart. I think that should make us pause. We should consider what it is that the clinicians want of us. Dr. Christian freely grants a superior accuracy of x-ray methods, that is, accuracy over methods of percussion in outlining the heart, but he says that there is no need of such accuracy. He has never found it of any value whatever to know slight changes in the size of the heart, either in diagnosis, prognosis or treatment of a case. You will observe in our work today that the effort has been toward accuracy of outline and of size. Whether in the future there will be clinicians who can make use of that increased accuracy is a question. At the present time evidently that is not so.

At the same time that this work comes out we note that the *American Journal of Medical Sciences* has in it an article which is really a résumé of roentgenological and clinical observations in 100 cases of heart disease. It is interesting to compare these two recent publications. I know of course that we cannot take the required time now but we can consider one chapter of Christian's work, namely, that on chronic myocardial disease, a term which he uses in preference to myocarditis, because he says there is no real inflammation of the heart muscles. In this disease, which he says constitutes over 60 per cent of the cases of heart disease entered at the Peter Bent Brigham Hospital, he states that there is no murmur present. Apparently even at the time

of the microscopical examination of the heart muscle there are no changes that the pathologist recognizes. There are few symptoms indeed to indicate that there is anything present that could be called heart disease, yet the patient presents the clinical picture of heart disease, with cardiac insufficiency. The one characteristic of this disease is an enlargement of the heart, a hypertrophy, the muscle increases greatly in quantity, and yet is a very inefficient muscle. If there were ever a condition where the roentgen demonstration of the size of the heart should be of value, it would be in chronic myocardial disease. Yet Christian seems to think that here methods of percussion are ample. It would seem, however, as though the x-ray would really be of service in this condition and could actually aid the clinician in the diagnosis.

I think this morning you have heard varied discussion about the size of the heart, but I did not hear anything to indicate that the size of the heart depended also on the weight of the individual and his height. Certainly the size of the thoracic cage cannot be used as an indication for the size of the heart. I think that the methods of Bardeen have fallen into an undeserved disuse because we can estimate truly only an increased size, a hypertrophy of the heart that is not massive, by estimating the actual volume of the heart in relation to weight, height and sex. If this were done I believe that the earlier stages of myocardial disease could be detected in this way better than any other.

Dr. White stated as his objections to the roentgen examination that it was of use only in advanced heart diseases, and did not indicate any of the beginning changes, but here is a class of cases constituting over half of all heart cases entered in the Peter Bent Brigham Hospital, in which it would seem that an early roentgen examination might demonstrate to an experienced clinician that actually this important disease is in progress.

Dr. F. J. Hodges, Madison, Wis. I think that Dr. Holmes is to be congratulated most particularly upon including Dr. White in the program because we have had the opportunity of seeing the clinician epitomized by a man who is certainly at the head of his field, taking stock of us out loud and without caring about stepping on people's toes and I think that he has certainly hit the nail on the head very accurately in pointing out to us that we are overenthusiastic in trying to arrive at numerical perfection in a field where such accuracy will never be attainable.

Dr. White has thrown a scorching searchlight on our work and has emphasized certain limitations of this method of cardiac study. If all of us were to thoroughly realize our limitations and to accept them as such, all of the fun and zest would be taken out of the roentgenological study of cardiovascular disease. This morning's papers show that roentgenologists are not willing to admit that certain limitations of their methods are serious handicaps. The papers by Dr. Dann and Dr. Warren have shown new applications of roentgen methods in the field of cardiology. I believe that in the matter of size alone we have our greatest opportunity to contribute information concerning heart disease.

I am very much pleased to know that Dr. White is installing orthodiagraphic apparatus of his own. At Wisconsin, we rely heavily upon orthodiagraphic methods and feel that they offer us the greatest amount of information that it is possible to obtain in a short length of time about heart disease.

I feel that his experience will be similar to the experience of some of the cardiovascular men in Chicago who have taken up this method; that at first he will be completely disgusted with his results, that his cardiac outlines will resemble a small school boy's picture of a barn, but that gradually as he learns to accept a certain degree of accuracy without expecting numerical perfection, he will begin to lean more and more upon his orthodiascope as a method of convincing him of the presence or absence of heart disease in any one case.

Dr. Crane mentioned the fact that height and weight and age must be taken into consideration in considering heart size. Undoubtedly true, and I would simply like to call attention to a table which was published by Dr. Eyster in *Radiology* in 1927 which will also answer one of the points that Dr. Paterson brought up as to the number of times in which normal heart size by the Eyster tables is found in cardiac disease, otherwise demonstrable. His chart shows very graphically a base line with area measurements in normal individuals scattered uniformly up and down, seldom over

plus or minus 10 per cent and never over 15 plus or minus. It shows further that simple mitral stenosis gives an average of about 8 per cent plus, that the scatter never goes above or below 20 per cent. In other words, uncomplicated mitral stenosis results in but slight increase in cardiac size. Combined mitral lesions result in a variable degree of increased cardiac size, averaging a 30 per cent increase. Aortic lesions result more uniformly in marked increase in size. In the case of multiple valvular lesions involving two or more valves, no cases fall within the normal range and the average degree of enlargement is just about plus 70 per cent.

Dr. Crane brought up the question of the relation of myocardial disease to heart size. Eyster has shown a wide range of variation in heart size in cases with myocardial disease, the average being an increase of 25 per cent over the normal.

I think exactly as Dr. Crane does, that age, height and weight should be taken into consideration just exactly as these criteria are considered in the estimation of basal metabolism and just as the surgeon disregards a very slight variation from the normal and erects rather loose boundaries between the normal and the pathological case, so we think that heart size determination will never become mathematically accurate but nevertheless may be of very considerable clinical value to the examiner.

Dr. Howard E. Ruggles, San Francisco, Calif. It is rather surprising that of all the internal organs, the heart, which is the most accessible to direct examination by x-ray, has been the last to be studied intensively, and there is still much to be done. We are now getting well into the matter of measurement, size and form. There is still the field of function which is as important in cardiology as it is in gastroenterology and that is what we must look forward to. There is a great deal to be done in the matter of observing the heart in action, both under conditions of rest and after exercise, which will undoubtedly give us valuable information that we are missing at the present time.

There is an article by Palmieri in a recent number of *Acta Radiologica*. He has a method of obtaining casts of the living heart by means of successive profiles of the viscus taken with the patient rotated about a vertical axis. Then by substituting a wire for the roentgen beam and a nail for the target of the tube he carries the wire around each profile in turn, cutting down through a lump of clay placed in the position of the patient's heart and properly rotated. The final result is a remarkably accurate reproduction of the organ. These casts should be of great value in teaching.

Dr. Leon T. LeWald, New York City. I think the method of showing changes in the heart size roentgenographically is of extreme value. Dr. Holmes very kindly mentioned some work that I did in regard to determining the effect of altitude on the heart. In that work it had been erroneously concluded from auscultation and percussion that the heart dilated at heights over twenty thousand feet. Roentgenography was called in to check that finding and *roentgenology reversed* those findings and showed conclusively that the heart does *not* dilate as a result of altitude or deprivation of oxygen in the case of aviators. So that here is an observation where roentgenography, in the study of individual hearts, under various conditions, is of the greatest value. The confusion probably comes from the question of what is the actual normal size of the heart of different individuals, and of course the variations there, as Dr. Crane has brought out in regard to height, age, sex and so on, show such extreme variations that it is very difficult to take a particular heart at a particular time and say whether that heart is slightly enlarged or not, but by studying that particular heart under the same conditions at different times, one can accurately say whether that heart changes or not.

Dr. White (closing). May I just add a word in closing my remarks and partly in answer to Dr. Hodges? I presented, I confess in a rather pessimistic way, the views of many clinicians working on heart disease concerning the value of roentgen study at the present time. I think I am more interested, however, in the subject than are many internists and I believe there is a great deal of progress to be made. Much has been learned in the past with regard to the heart in health and disease from roentgen study. I am a very keen advocate of further roentgen study and progress and that is why I am taking it up more actively myself, but we must now and then establish the line of our limitations

and not unwisely or unnecessarily do a lot of detailed work that may be less valuable than the work that is shown to be of first importance after establishment of these limitations.

Dr. Dann (closing). I fully agree with many of the things that Dr. White has said. Any one who has had an experience over a period of years becomes quite conservative and I seldom go beyond the attempt to describe these volumetric changes in the heart and great vessels. I am glad that Dr. Ruggles and Dr. LeWald brought out the point of the use of the roentgen ray as a study in physiology.

Dr. Warren (closing). I think we have all been aware of the fact that measurements made in roentgenograms of the heart have not always been as satisfactory in giving clear-cut clinical diagnoses as they might be. The accuracy of course of the x-ray depiction of what is in the thorax is far beyond our clinical correlation of these findings, that is, the roentgen diagnosis cannot be made so accurately as to conform always with what is shown upon the film because of the personal element involved and lack of experience. We have therefore undertaken about a ten-year program to bring about this correlation. We have started in by studying the amount of distortion at various distances. This paper is in press. The study I gave today is a preliminary account of measurements made on the oblique view of the heart.

We have found that as we shorten the exposure, we have to take into consideration the error due to systole and diastole. This may amount to as much as a centimeter (0.5 to 2 cm.) in the transverse diameter so that next we must develop a method much like that which McPhedran of Philadelphia uses to trip the switch at a definite time in the heart cycle. After we have done that, we can then compare serial examinations of the heart over a long period of time. I say ten years because, as Dr. White and others have pointed out, we have to study heart disease in its beginning, and then follow the changes as they are produced. It is true we are unable to make a diagnosis until the heart disease is well advanced, for there is general dilatation of the heart only with profound myocardial damage. The majority of the cases which I showed tracings of had that difficulty.

Dr. Steel (closing). Our work in Cleveland has been done under practically the same conditions as Dr. Holmes' and Dr. White's work, and I think I can appreciate very keenly Dr. White's stand. I agree absolutely with him. It is very difficult, if not impossible, to differentiate between a dilated aorta of lues and hypertension in certain cases and we should be satisfied to describe the changes and let the clinician draw the final conclusion. In early cases of young adults a dilated aorta and no history of a hypertension justifies a diagnosis of a luetic process. It is better to diagnose a combined lesion than it is to be too specific. We should attempt to build the clinician's faith in the method.

We have found teleroentgenograms to be far more reliable than percussion in the measurements of the heart. True, percussion is all right in the hands of an experienced clinician. A personal variation enters into percussion which is not present in plates. The roentgen method has a distinct future and its value will be shown only by conservatism.

Dr. Jones (closing). There are just two things I should like to mention. One is in the group of cases that we reported of about 80 luetics—80 per cent of the cases agreed clinically and by roentgen studies, which is a fairly good agreement. The remaining 20 per cent in which there was clinical luetic aortic disease, but no aortic dilatation by x-ray is perhaps the most important group, because these cases should be studied over a long period of time and observed to see whether an aortic dilatation does develop, or the case is autopsied to prove whether or not luetic aortic disease was present.

The other point is that the finding of an aortic dilatation by x-ray with whatever methods used, should not lead one to make a roentgen diagnosis of luetic aortitis, the clinical facts and other roentgen findings must be taken into consideration.

Dr. Paterson (closing). There is only one point that I would like to stress again. The examination of the esophagus in studying heart disease is no new thing. The bronchus, however, is very often directly affected in mitral disease. I believe that this is a new observation, and think that it possibly accounts for a great deal of the lung symptomatology which arises in heart disease, and is often passed over under the diagnosis of passive congestion. I believe that some of the symptoms so classed, arise through mechanical interference with the bronchus, rather than as a result of interference with the blood supply, in heart conditions.

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INJURIES RESULTING FROM IRRADIATION IN BEAUTY SHOPS

By H. H. HAZEN, M.D.
WASHINGTON, D. C.

ABOUT five years ago a number of beauty shops in various cities installed roentgen machines for the purpose of treating superfluous hair. It is well known that from 1 to 2 mm. of aluminum was used as a filter. However treatment was given for other conditions than hypertrichosis. In my list is one who alleged that she was treated for acne, and another who alleged that she was treated for freckles. The 10 women who form the basis for this study state that their injuries were received in one or another beauty shop in the East.

In various meetings there have been many reports of damage to the skin alleged to be due to roentgen-ray treatment in beauty shops, but so far there have been no reports of damage to the gums as a result of this treatment. In this series of 10 cases no less than 7 women have received serious damage to their gums. This fact seems worthy of record.

CASE REPORTS

CASE I. Miss D. M., aged twenty-six, was treated for superfluous hair upon the hands, forearms, axillae, chin, and an outer portion of the right upper lip. Examination revealed numerous telangiectases of the hands and arms, atrophy and telangiectasis in both axillae, wrinkling of the skin of the chin and telangiectasis beneath the chin; the upper lip showed marked atrophy and telangiectasis. One of the most interesting features was a marked atrophy of the gums beneath the upper lip. There was retraction of the gum of nearly one-quarter of an inch, and the first molar, canine, and one incisor were distinctly smaller than the teeth on the other side. This was apparently due to some atrophy in the dentine. This patient states while taking the treatments there was severe, deep aching pain in the upper jaw.

CASE II. Mrs. A., aged thirty-eight, showed marked wrinkling of cheeks and chin and numerous telangiectases over this area.

CASE III. Miss H., aged twenty-eight, showed wrinkling and large blotchy telangiectases beneath the chin. There was considerable atrophy and retraction of the gums of both upper and lower jaws. The patient stated that she stopped the treatments because of severe, constant pain in both jaw bones. Fortunately roentgenograms of all teeth, taken just before the roentgen treatments, were available for study. It was apparent that the gums had retracted nearly one-eighth of an inch, but there was no decrease in the size of the teeth.

CASE IV. Mrs. P., aged thirty-two, showed numerous telangiectases of the forearms, and of the legs from knee to ankle; there was marked atrophy of the skin of both legs. This patient was seen while taking treatments and showed first degree burn. The telangiectasis appeared in from twelve to eighteen months.

CASE V. Mrs. G., aged thirty-five, showed wrinkling of cheeks and chin, and numerous blotchy, purplish telangiectases of cheeks and chin; both upper and lower gums showed marked retraction. This patient stated that about the time she ceased treatments there was a deep ache in both jaw bones for periods of an hour or two.

CASE VI. Mrs. Z., aged fifty-five, showed telangiectasis of the cheeks and chin with marked wrinkling. There was marked retraction of the gums which she stated was not present before the treatment was started. This patient also gave a history of pain in the upper jaw bone developing during the course of the treatments.

CASE VII. Miss S., aged thirty-two, showed marked wrinkling, and telangiectasia of cheeks and chin.

CASE VIII. Mrs. B., aged forty-three, showed wrinkles and atrophy over entire cheeks and chin, and also retraction of the gums in both upper and lower jaws. Patient stated that although treatment has been stopped for a year she still has deep pain in both jaw bones.

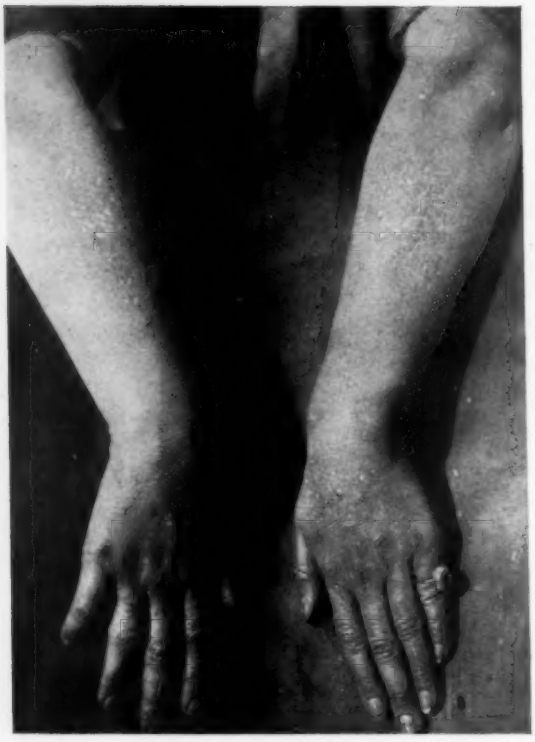

Fig. 1. This patient shows extensive telangiectasia on the extensor surface of the forearms, the backs of the hand, and the proximal phalanges of the finger. The white puncta are due to unduly deep monopolar endothermy.

Case ix. Miss M., aged thirty, showed telangiectasis of the forearms, and both sides of the legs from knee to ankle; beneath the calf of the left leg there is a depression of some 2 inches in diameter and nearly 1/2 inch in depth, skin surrounding this for an area of nearly an inch is stony hard, and absolutely immobile. The cheeks and chin showed numerous telangiectases and characteristic wrinkling. The gums showed numerous telangiectases and they were markedly atrophied and retracted; there was no atrophy of the dentine.

Case x. Girl, aged nineteen, was treated for acne. She showed wrinkling of face, telangiectases beneath the chin, and atrophy and retraction of the gums of both jaws.

In the 10 patients in question there occurred:

Telangiectasia, face	9
Telangiectasia, axillae	1
Telangiectasia, arms	3
Telangiectasia, legs	2
Deep atrophy, muscles	1
Atrophy and retraction, gums	7
Telangiectasia, gums	1
Atrophy, dentine	1

The telangiectases of the face are interesting because instead of small dilated capillaries there are found as the predominating type of vascular lesions areas of venous engorgement from 1/16 to 1/3 inch in diameter, and of an unusually deep purplish color, especially after exertion. As time goes on there is a tendency for the purplish shade to become paler.

The telangiectases of the legs show a much deeper purplish hue than do those of the arms; this is probably a result of stasis due to gravity.

The deep atrophy of subcutaneous tissue and muscle showed remarkably few skin changes. The skin was slightly browner and thinner, but there were no more telangiectases than upon other portions of the leg. There was no evidence of keratoses.

Fig. 2. There is marked induration of the subcutaneous and muscular tissue from the middle of the calf to the tendon of Achilles. Note actual loss of tissue, telangiectases and presence of hair.

Fig. 3. Wrinkling of the chin is well shown, but the large port-wine stain-like telangiectases can be seen but faintly. A number of areas of atrophy are clearly distinguishable. Despite the skin changes many hairs are still present.

Seven of the 9 women who had facial changes still showed some hair in the atrophic and telangiectatic areas. The patient with axillary involvement was completely rid of hair. Two of the 3 who had suffered burns upon their arms still had some hair present and both of the patients with burned legs still had a considerable amount of hair. This would point very strongly to the correctness of the view that it is impossible to remove hair from the face or body with roentgen rays and avoid atrophy of the skin. In other words, sufficient roentgen radiation to remove hair permanently will, in a high percentage of cases, damage the skin to a visible extent. It is unfortunate that there are still roentgenologists and dermatologists who believe the contrary. Within the past few weeks a young girl was seen with a second degree radiodermatitis of the back of the neck as the result of the attempt of a dermatologist to remove hair by irradiation. The treatment of hypertrichosis by roentgen rays still deserves condemnation.

Telangiectasia of underlying mucous surfaces has been repeatedly reported as the result of deep roentgen therapy. Within the past two years repeated instances of this occurrence in the larynx have appeared in the medical literature. But a survey of the recent literature has revealed no instance of atrophy and retraction of the gums as a result of irradiation. Apparently this fact is not unknown to certain of the legal profession for in a damage suit recently filed in the District of Columbia the plaintiff alleged "permanent damage to her gums." As a matter of fact, the change is striking. The entire gum underlying the exposed area is noticeably thinned and atrophic, the roots of the teeth almost to the apices show through the mucous membranes. Apparently there is some resorption of the gingival portion of the jaw bones as well. In one instance the four teeth under an exposed area on the upper lip were distinctly smaller in size than the corresponding teeth of the other side. The length was slightly less and the diameter was distinctly less, although unfortunately this was not measured.

The history of "deep boring pains" in the jaw was given by 5 patients. In one instance this developed fairly early in the course of treatment. Three of the patients describe the pains as very severe, and at least one stopped treatments because of them.

It is worthy of note that in every in-

Fig. 4. This photograph shows retraction and atrophy of the lower gums. The numerous telangiectases of the gums do not show.

stance there is the history of an erythema following the third or fourth treatment and of subsequent irradiation being given in the presence of it. One can only marvel at the stupidity of the operators, and the fortitude or ignorance of the victims. Any move that can be made to protect beauty-seeking women from their own folly is to be commended. It is amazing that in many communities medical practice acts include only the prescribers of drugs, and permit any type of physiotherapist to apply his trade without let or hindrance, with a total disregard for the potential dangers of the therapeutic procedure.

While no attempt is made to discuss the treatment of roentgen-ray telangiectasis, one point should be mentioned. All persons with roentgen damage to their faces should be warned against having their teeth roentgenographed, at least until the dentist has been fully informed of the condition.

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PHYTOBEZOAR IN THE STOMACH

CASE REPORT

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ROCHESTER, MINNESOTA

PHYTOBEZOAR, or food ball within the stomach, has ceased to be a pathologic curiosity since the common use of the roentgen ray in the search for gastric diseases. Maes,* in 1928, in a review of the literature of bezoars, found reports of 139 cases, of which 23 were phytobezoars. Of the latter, persimmon balls seem to be most common, probably because of the high percentage of adhesive material (gum 14.1 per cent and pectin 7 per cent) found in such masses.

The following case of persimmon ball within the stomach is presented because of the significant history, the large size of the mass, and its similarity, roentgenographically, to a large gastric neoplasm.

A man, aged forty-eight, came to the clinic December 16, 1929, complaining of distressing pain and a grinding sensation in the epigastrium of about three months' duration. The patient had been well until about two and a half months previously, when he had eaten a large quantity of persimmons. There had been no immediate discomfort, but gradually he had begun to have distress in the epigastrium, with a sensation of pressure and grinding. This came on about three hours after meals. It was partially relieved by milk, which created a feeling of fullness in the stomach and aggravated the condition later. About a month previous to examination the distress began to awaken the patient at night.

General examination was essentially negative. The results of urinalysis and the blood count were within the normal range. After a test meal the total acidity of the gastric content was 60, and the free hydrochloric acid 40 in terms of cubic centimeters of tenth-normal sodium hydroxide; blood or remnants of food were not present. A persimmon-seed ball was suspected clinically.

The roentgen examination revealed a large mass within the stomach, apparently a phytobezoar (Fig. 1). During roentgenoscopic examination the barium meal split as it entered the stomach and coated the walls of the intragastric mass. The gastric walls were flexible, and the stomach was freely movable. Peristalsis was feeble but present throughout. Gastric stasis was not manifest except by a few flecks of barium remaining on the walls of the mass. The roentgenogram showed an irregularity, especially of the greater curvature in the lower third of the stomach, which was not unlike that caused by intrinsic disease. The roentgenoscopic observations, however, eliminated that possibility.

Abdominal exploration revealed a large, sausage-shaped mass lying in the fundus of the stomach, very characteristic of a persimmon-seed ball; the consistence was that of putty. The mass was about 15 cm. in length and 5 cm.

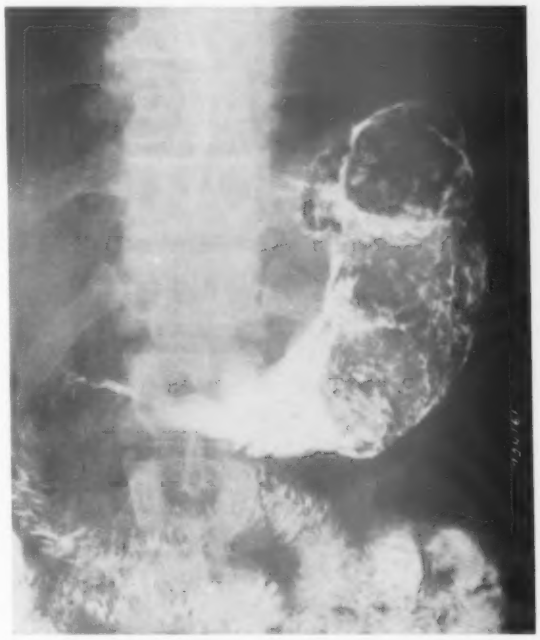

FIG. 1. Roentgen appearance before operation.

* Maes, Urban. Bezoars, with the report of additional case of phytobezoar. *Ann. Surg.*, 1928, *88*, 685-692.

Fig. 2. Specimen removed at operation.

in diameter, and the ends were rounded (Fig. 2). There was a subacute gastric ulcer on the posterior wall just below the angle, with a shallow crater, in all probability caused by the foreign body. It seemed reasonable, in view of the history of patients with foreign body in the stomach, to expect the ulcer to heal after removal of the irritating mass. An opening was made in the anterior wall through which the tumor was removed. Convalescence was uneventful, and the patient was dismissed from the hospital on the twelfth day.

A fair percentage of phytobezoars is associated with gastric ulcer, which in most instances is of the type caused by a foreign body. Because of the superficial nature of these ulcerations and the shallow craters, it is doubtful that barium sufficient to cast a shadow of a niche is often retained in them. The flecks of barium adherent to the walls of the mass also complicate the search for associated ulceration.

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PRIMARY CARCINOMA OF THE LEFT BREAST ASSOCIATED WITH EARLY METASTATIC INVOLVEMENT OF THE RIGHT SCAPULA

CASE REPORT

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WE WERE unable to find in the literature a case of primary carcinoma of the breast in which the initial bony metastasis appeared in the scapula. We are reporting this case for the following reasons: (1) Initial metastatic involvement of the scapula is rare. (2) Physical evidence of the metastasis was preceded by an erythematous blush of the skin covering the left half of the chest and upper extremity. This developed within a few hours, reached its maximum at the end of fifteen hours, was associated with recurrent lymphedema of the left upper extremity and presaged the breakdown of the defense against the advance of the disease. We found no record of metastasis to any part of the skeletal frame being preceded by an erythematous cutaneous reaction as was observed here. (3) The above second point together with the history (that of blood-borne susceptibility, a sister having died at the age of fifty-two of cancer of the breast and axilla, and a daughter aged thirteen who had a Paget's disease of the nipple) would favor the assumption that the secondary deposit in the right scapula was embolic in origin.

The involvement of the scapula by metastatic cancer cells from the breast or elsewhere is uncommon. Handley[7] reports involvement of the scapula in 0.3 per cent of cases. Williams[16] states that in 893 necropsies the scapula was involved in 1.2 per cent, being less frequent only in the leg bones 0.9 per cent, forearm bones 0.45 per cent, sternum 0.45 per cent. Meyerding, Carman and Garvin[10] reviewed the records of 1985 cases of breast cancer at the Mayo Clinic over a period of seven years and found that the scapula was involved in about six-tenths of one per cent of cases (in all cases the entire bony structure was roentgenographed). Besley,[3] Bendick and Jacobs,[2] Walker,[15] and Clayton,[5] report cases in which the scapula was involved secondarily to cancer of the breast, in all of which there was general bony metastasis and in two, both scapulae were involved. Joll[8] reports 2 cases with scapular involvement following cancer of the thyroid gland. In addition Symmers,[13] Oliver,[12] Levin,[9] Giles,[6] Christensen,[4] Beatson,[1] Neal and Robnett,[11] and Thompson and Keiller[14] report cases of skeletal metastases associated with cancer of the breast but do not mention involvement of the scapula. Of a total of 3426 necropsies that we were able to collect from the preceding and other sources where death was due to cancer of the breast 17, or 0.49 per cent, had involvement of the scapulae.

The following case report demonstrates clearly that bone metastasis may take place before gross evidence of metastasis occurs in the lungs, mediastinum or liver. In this particular instance we believe that the cancerous process penetrated either the jugular or subclavian vein, the cells being scattered throughout the systemic circulation. Whether or not this occurred at the time of the erythematous involvement of the epidermis of the left chest cannot be definitely stated. However, it seems highly probable when we consider that the erythema presaged a complete breaking down of the patient's resistance to the disease. One of us observed the same phenomenon

in another case of carcinoma of the breast where rapid dissolution was preceded by an erythema followed by dissemination to the opposite breast, neighboring lymph nodes and mediastinum. Why the lungs escaped, grossly, can probably be explained by Schmidt's investigation in which he found that following cancer of the breast embolic infection of the lungs is common, but only about 10 per cent of the secondary growths were large enough to be seen—90 per cent were microscopic, invisible and unsuspected. In other words, the lungs in the majority of instances are involved but the area is not sufficiently dense or large enough to cast a shadow on the roentgenogram. Experimentally it has been shown that only a small percentage of cancer cells that enter the systemic circulation live—apparently the destruction of emboli in the lungs takes place by infarction and organized thrombosis.

Handley's theory of permeation for bone infection we believe does not hold good for this case. We have definite evidence of a predilection of a certain organ by a certain disease—two sisters and a daughter of one of the sisters had diseased breasts. Why the breasts in these individuals were predisposed to the disease we do not know, but the fact justifies the assumption that whatever the condition was it was blood borne. Lymphatic permeation—centrifugal extension cannot explain this metastasis, which would primarily involve the scapulae, ribs, sternum or humerus on the same side as the disease.

Invasion of the blood stream by cancerous emboli can, on the other hand, be easily explained, not only by direct extension—the axillary vein was two-thirds surrounded by a cancerous mass at time of operation—but by the process described by Goldmann who showed by microscopic investigation that the vessel walls may become invaded by the cells of the growth, carried to them by the nutrient vasa vasorum which according to his investigation are devoid of lymphatics. The cancer cells multiply in the vessel walls especially below the intima and finally break through into the lumen of the vessel whence they can easily be carried into the general circulation.

CASE REPORT

Female, aged fifty-four.

Family History. Negative except that one sister died of cancer in the axilla at the age of forty-five (not determined whether primary in breast or axilla).

Previous History. No previous illness except influenza at the age of forty-four—says she has lost 10 pounds within a period of two years.

Marital History. Menstrual history negative. Menopause at age of forty-seven. Mother of 10 children, 8 living and well. One of a set of twins, aged thirteen, developed an enlargement of the nipple and areola of the left breast which resembled a beginning Paget's disease. Microscopic section was negative for malignancy. It was necessary to destroy the nipple completely by several applications of radium before a cure was obtained. Patient is well after twelve months.

Present Illness. About three months before examination patient noticed an enlargement in the left axilla about the size of a hazel nut. This gradually increased in size; in the beginning it was not associated with pain but within the past month a drawing pain has developed in the axilla, radiating down the flexor aspect of arm and forearm to the wrist joint.

Physical Examination. A well-nourished female. Skin and mucous membranes of normal color. No abnormality worthy of notation except the following: The chest showed a fullness of the anterior axillary fold and axilla on the left side associated with a slight fullness in the infraclavicular region. The breast was negative on inspection and palpation. The nipple and areola were normal as compared with the other breast. Examination of the axilla disclosed fixed, hard, craggy glands, varying in size from 0.5 to 3 cm. in diameter. There was no palpable supraclavicular enlargement and the breast as previously stated was apparently negative. A diagnosis of malignancy was made and the family informed. They consulted another surgeon who concurred in the diagnosis of primary carcinoma of the glands of the axilla and suggested that irradiation might be tried

but he felt that irradiation and surgery would probably be the best form of treatment. His examination of the breast was apparently negative. The patient was admitted to the Samaritan Hospital three days after the examination. On the morning of the operation the patient stated that a lump had appeared in the breast over night. This was inspected and in the upper outer quadrant was found a nodule less than a centimeter in diameter, fixed to the epidermis and having all the characteristics of a primary malignant growth. (It is my opinion that this growth escaped the examining fingers of all of us.)

A radical operation was done, 25 mg. of radium screened in a 2 mm. brass capsule covered with 2 mm. of rubber was placed in the axilla and a brass capsule containing 25 mg. was inserted into each of the second, third and fourth intercostal spaces. These capsules were attached to a tape and were withdrawn at the end of twelve hours. On cross section the small nodule in the breast disclosed the typical cut-pear appearance of cancer. The axillary glands were removed with difficulty. One gland about 3 by 2 cm. completely surrounded the axillary vein. Dr. J. H. Clark reported that the growth was a carcinoma simplex; the glands showed definite metastatic involvement.

The patient's operative convalescence was normal and she was given the usual post-operative roentgen treatment. She continued to improve for five months when a member of the family noticed that the right scapula below the spinous process was enlarged. There was also noted at this time a moderate enlargement of the supraclavicular glands on the left side. Preceding the scapular and supraclavicular enlargement the left half of the chest became suffused with blood, the epidermis was bright red and slightly edematous as was the left upper extremity, the latter more so than the former. The patient insisted that this appeared over night. The roentgen examination by Dr. G. C. Bird showed a honeycombed appearance of the right scapula. The lungs and mediastinum were clear. A radium pack was placed over the scapula and supraclavicular region. A total of 3200 mg-hr. was given. This was followed by intensive roentgen irradiation and within three weeks there was a marked diminution in the size of the mass in the scapula and a moderate decrease in the size of the supraclavicular nodes. The patient became progressively weaker, however, and died August 6, 1929, ten months after apparent onset of the disease and eight months after operation. Permission to perform an autopsy was refused.

Fig. 1. Roentgenogram of right scapula showing moth-eaten appearance of the body of the scapula.

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EDITORIALS

WILLIAM HENRY WELCH

THE CELEBRATION OF HIS EIGHTIETH BIRTHDAY
APRIL 8, 1850—APRIL 8, 1930

ON APRIL 8, the Dean of American Pathologists, Dr. William Henry Welch, will have successfully achieved the eightieth celebration of his birthday; and there will gather in Washington, at that time a notable assemblage of colleagues, friends, old students and distinguished guests, who will unite in rendering him richly deserved honor. As an investigator, teacher and organizer in medical education Dr. Welch stands preëminent among American medical men of today. To him more than to any other single individual was due the development of the Johns Hopkins Hospital and Medical School, and the choosing of that first wonderful faculty, which for a generation gave to that school its great prestige over all other medical schools in the United States, and exerted so powerful an influence in determining the lines of development of medical education throughout the entire country. For to the development of the Johns Hopkins Medical School, Welch brought a first-hand knowledge and experience of European University Medical Schools, and with that knowledge the ideals and determination to make medical education at the Johns Hopkins Medical School the equal of the best Continental models.

Dr. Welch, after the completion of his year and a half interneship had gone abroad in 1876, at a most wonderful period in the evolution of medical science and philosophy. Virchow had just established Cellular Pathology upon a solid foundation, and the great discoveries of Pasteur were just about to give birth to the new science of Bacteriology and Parasitology. Those great masters of German Medical Science, Waldeyer, Ludwig, Wagner, Cohnheim, Klebs, and von Recklinghausen, were at the height of their intellectual activities, and under each one of these Welch had the good fortune to work. A wonderful opportunity, indeed, for a young American of Welch's turn of mind. Of eager, open and receptive mentality, Dr. Welch showed even at this early period that peculiar quality of mental balance which so characterized his later intellectual development. Back in New York in 1878, Welch began his career in medicine, and soon made for himself a position as an exponent of the new pathology. Then came the Johns Hopkins offer and the opportunity for which he was waiting, of developing pathology in America along the German lines of advance, that of experimental pathology and bacteriology. While awaiting the building of the Johns Hopkins Hospital, Welch again went to Germany, in 1884, this time to work with Koch in Berlin, and with Flügge in Göttingen. To these two German experiences, so far-reaching in their influence, Dr. Welch would be the first to acknowledge his great indebtedness.

Returning to Baltimore in 1885 he at once began to develop a department of pathology on German lines, and so founded a new era in medical education in the United States. His laboratory became an active center of influence for investigation and teaching. He stood for what was then regarded as revolutionary and modern. Pathology in the United States was at that time in a dead backwater. Hunterian

WILLIAM H. WELCH

UNIV OF MICH.

methods of gross observation still ruled; for these Welch substituted the vital method of experimental investigation. When he became the first dean of the new medical school the same progressive ideals guided his administrative policies, and the school became notably one distinguished for productive investigation in medical science, attaining a position which it held preëminently for over a generation. Three volumes of published papers and addresses attest to his scientific achievements during this long period of activity in pathology and in medical education.

When the time was ripe he gave up his association with the department of pathology to found the School of Public Health and Hygiene, which, once accomplished, he is now bringing his long career of medical science to a happy climax in the development of the new medical library, lending himself particularly to the building up of the section on Medical History. Surely a full and well-rounded life! Fortunate is he, in reaching his eightieth birthday, to see the many fruits and rewards of his ideals and labors manifested in such concrete form as the deep appreciation and honor paid him by the members of the medical profession, not only of America, but of the entire world. For the influence of his life and work extends far beyond the limits of this country; he is leaving his imprint upon the development of medical science for the whole world.

ALDRED SCOTT WARTHIN

ROENTGENOLOGY OF THE HEART*

PROBABLY the first publication in English on the use of the roentgen ray in examination of the heart, and certainly the first in this country, was a paper by Francis H. Williams of Boston, entitled "Notes on X-ray in Medicine" read before the Association of American Physicians in April, 1896, and published in the transactions of that Society. In it he states that the pulsation of the ventricle, and sometimes that of the auricle, can be distinctly seen and reports the following case: "The first medical case examined was that of a man with an enlarged heart (seven inches in transverse diameter). I found that the outline of the heart as seen from the front of the chest through the fluoroscope corresponds in a general way to the outline drawn on the skin with percussion. It was interesting to note that the heart could be made out through the man's waistcoat and two shirts."

Among those who took part in the discussion was Dr. William Osler, who asked if it was possible to see gallstones with the fluoroscope. That question has been asked many times since. In October of the same year Dr. Williams published in the *Boston Medical and Surgical Journal* an article entitled "A Method for more Fully Determining the Outline of the Heart by Means of the Fluoroscope." That article would be considered good today and some of the illustrations are comparable to those that we have at the present time.

In the first edition of Williams' book* which appeared in 1901 there is a chapter on the heart which is well worth reading. Many of the observations which he made have been confirmed or rediscovered. Some of them which seem to me to be of real value are not generally known. He was probably the first to describe the angle formed by the heart, the spine and the diaphragm, and he states that this angle is lost when fluid accumulates in the pericardium; he describes the change in the size of the heart with change in position of the diaphragm, and explains the lateral movement of the heart due to failure of the dia-

*Williams, Francis H. The Roentgen Rays in Medicine and Surgery. Macmillan Co., New York, 1901.

*Remarks preceding the Symposium on the Heart at the Thirtieth Annual Meeting, American Roentgen Ray Society, New York City, Sept. 17–20, 1929.

phragm to move equally on both sides. The errors which occur in obtaining the size of the heart by percussion are discussed, the effect of interference with the pulmonary circulation is described, and attention is called to the value of the roentgen examination in following the result of treatment.

I would advise everyone who contemplates a roentgen study of the heart to read Williams' book, particularly the chapter on the chest and heart. It is out of print but it can still be obtained from libraries and secondhand dealers.

Among the early contributions to this subject was a paper on the diagnosis of aneurysm and its differentiation from the tortuous aorta by Pfahler in 1903; and an article by Baetjer in 1906, in which he classifies the various types of aneurysm.

In the fall of 1916, A. W. Crane of Kalamazoo, Michigan, published a method of obtaining polygraphic slit tracings of cardiac pulsations which he called "roentgenocardiograms." Dr. Crane was not the first to describe this method but it was largely due to his work that it came to be recognized in America as a practical procedure.

Among others who have made important contributions to the study of the heart are: C. R. Bardeen, professor of anatomy at the University of Wisconsin, who published a very interesting and valuable method of measuring the area of the cardiac shadow; J. G. VanZwaluwenburg, late professor of roentgenology at the University of Michigan, who described a method for determining the relative size of the auricles and ventricles; L. T. LeWald, New York City, who did some excellent work on the roentgen anatomy of the heart and who has also published valuable papers on the effect of high altitudes, and H. E. Ruggles and W. E. Chamberlain of San Francisco who have produced excellent moving pictures.

In this brief statement of the early work on roentgenology of the heart in America, I have mentioned only a few of the contributions which seem to be the most important, but no doubt equally important work has been omitted.

The papers which have been prepared for the Symposium on the Heart are, for the most part, by men who have received their preliminary training in the American clinics. They have not been unduly influenced by the work done in the Continental clinics. Of course, we all recognize that in the German clinics more and probably better work on the heart has been done than in America, but we must not forget that some very excellent work has been done in this country.

George W. Holmes

WALTER T. BRONSON (1887-1929)

On DEC. 26, 1929, occurred the death of Dr. Walter T. Bronson. At the time of his death Dr. Bronson was director of the roentgen laboratories of Northwestern University on McKinlock Campus, Chicago, and was an instructor in roentgenology at that institution.

Dr. Bronson was born at Streator, Illinois, November 2, 1887, and after attending the graded and high schools of his birthplace he studied at Northwestern University and in 1910 received the degree of doctor of medicine from the Medical School of that University. In 1918 he was commissioned a first lieutenant in the Medical Corps of the U. S. Army and assigned to duty overseas. Upon his return to this county in 1919 he resided at Centerville, Iowa, doing a general practice. He remained there until 1922 when he returned to Chicago, where he was associated with the Englewood Hospital as roentgenologist. From this institution he joined the staff of Northwestern University. Dr. Bronson was a member of many medical and fraternal organizations and at the time of his death was the secretary-treasurer of the Radiological Society of North America.

SOCIETY PROCEEDINGS, CORRESPONDENCE AND NEWS ITEMS

Items for this section solicited promptly after the events to which they refer.

MEETINGS OF ROENTGEN SOCIETIES*

UNITED STATES OF AMERICA

AMERICAN ROENTGEN RAY SOCIETY
Secretary, Dr. John T. Murphy, 421 Michigan St., Toledo, Ohio.
Thirty-first annual meeting: West Baden, Indiana, Sept. 23–26, 1930.

AMERICAN COLLEGE OF RADIOLOGY
Secretary, Dr. Albert Soiland, 1407 S. Hope St., Los Angeles, Calif.
Annual Meeting, Detroit, Mich., 1930.

SECTION ON RADIOLOGY, AMERICAN MEDICAL ASSOCIATION
Secretary, Dr. G. W. Grier, Jenkins Arcade, Pittsburgh, Pa.
Annual meeting, Detroit, Mich., June 23–27, 1930.

RADIOLOGICAL SOCIETY OF NORTH AMERICA
Secretary, Dr. I. S. Trostler, 812 Marshall Field Annex, Chicago, Ill.
Sixteenth annual session: Los Angeles, Calif., Dec. 1-5, 1930.

RADIOLOGICAL SECTION, LOS ANGELES COUNTY MEDICAL SOCIETY
Secretary, Dr. Lowell S. Goin, Wilshire Medical Building, Los Angeles.
Meets on the third Wednesday of each month at the California Hospital.

RADIOLOGICAL SECTION, SOUTHERN MEDICAL ASSOCIATION
Secretary, Dr. W. S. Lawrence, Medical Arts Bldg., Memphis, Tenn.

BUFFALO RADIOLOGICAL SOCIETY
Secretary-Treasurer, Dr. Joseph S. Gian-Franceschi, 610 Niagara St.
Meets second Monday of each month except during the summer months, the place of meeting to be selected by the host.

CHICAGO ROENTGEN SOCIETY
Secretary, Dr. Robert A. Arens, Michael Reese Hospital.
Meets monthly on second Thursday from October to May (except during month of December) at Virginia Hotel. Dinner at 6 P.M., scientific session at 8 P.M.

CLEVELAND RADIOLOGICAL SOCIETY
Secretary, Dr. Harry L. Farmer, 2930 Prospect Ave.
Meetings are held at 6 o'clock at the University Club on the fourth Monday evening of each month from September to April, inclusive.

DETROIT ROENTGEN RAY AND RADIUM SOCIETY
Secretary, Dr. O. J. Shore, Fisher Building.
Meets monthly on first Thursday from October to May, at Wayne County Medical Society Building.

CENTRAL ILLINOIS RADIOLOGICAL SOCIETY
Secretary, Dr. H. C. Kariher, Decatur, Illinois.
Regular meetings held quarterly.

INDIANA ROENTGEN SOCIETY
Secretary, Dr. J. N. Collins, Indianapolis, Ind.
Annual meeting each February 22 in Indianapolis.

MILWAUKEE ROENTGEN RAY SOCIETY
Secretary, Dr. J. E. Habbe, 221 Wisconsin Ave., Milwaukee.
Meets first Friday in October, December, February and April.
Place of meeting designated by the president.

MINNESOTA RADIOLOGICAL SOCIETY
Secretary, Dr. L. G. Rigler, University Hospital, Minneapolis, Minn.
Next meeting Duluth, Minn., July 14, 1930.

NEW ENGLAND ROENTGEN RAY SOCIETY
Secretary, Dr. Thomas R. Healy, 370 Marlboro St., Boston, Mass.
Meets monthly on third Friday, Boston Medical Library.

NEW YORK ROENTGEN SOCIETY
Secretary, Dr. Robert E. Pound, Fifth Avenue Hospital.
Meets monthly on third Monday, New York Academy of Medicine.

CENTRAL NEW YORK ROENTGEN RAY SOCIETY
Secretary, Dr. D. S. Childs, 316 Gurney Bldg., Syracuse, N. Y. Three meetings a year—April, August and November.

PACIFIC COAST ROENTGEN RAY SOCIETY
Secretary, Dr. Harold B. Thompson, Seattle, Wash.
Two meetings a year.

PENNSYLVANIA RADIOLOGICAL SOCIETY
Secretary, Dr. W. E. Reiley, Clearfield, Penna.
Two meetings a year, April and October.

* Secretaries of societies not here listed are requested to send the necessary information to the Editor.

PHILADELPHIA ROENTGEN RAY SOCIETY
Secretary Dr. John T. Farrell, Jr., 235 S. 15th St., Philadelphia.
Meets monthly on first Thursday evening, Pennsylvania Hospital.

ROCHESTER ROENTGEN RAY SOCIETY, ROCHESTER, N. Y.
Secretary, Dr. James M. Flynn, 282 Alexander St.
Meets monthly on the first Friday evening at 7:45 at the Rochester Medical Association Building.

ST. LOUIS ROENTGEN CLUB
Secretary-Treasurer, Dr. L. R. Sante, Missouri Building
Meets first week of each month. Time and place of meetings designated by president.

TEXAS RADIOLOGICAL SOCIETY
Secretary-Treasurer, Dr. C. P. Harris, Houston, Texas.
Meets annually one day preceding the meeting of the Texas State Medical Association.

UNIVERSITY OF MICHIGAN ROENTGEN RAY SOCIETY
Secretary, Dr. D. M. Clark, University Hospital, Ann Arbor, Mich.
Meets every Wednesday evening from September to July, at 7:30 o'clock in the amphitheatre of the University Hospital.

VIRGINIA ROENTGEN RAY CLUB
Secretary, Dr. Wright Clarkson, 205 S. Sycamore St., Petersburg, Va.

British Empire

BRITISH INSTITUTE OF RADIOLOGY INCORPORATED WITH THE RÖNTGEN SOCIETY
Meets on the third Thursday of each month, from November to June inclusive, at 8:15 P.M., at 32 Welbeck St., London, W. 1., or as advertised.

ELECTRO-THERAPEUTIC SECTION OF THE ROYAL SOCIETY OF MEDICINE (CONFINED TO MEDICAL MEMBERS)
Meets on the third Friday of each month during the winter at 8:30 P.M. at the Royal Society of Medicine, 1 Wimpole St., London, W. 1.

SECTION OF RADIOLOGY AND MEDICAL ELECTRICITY, AUSTRALASIAN MEDICAL CONGRESS
Secretary, Dr. H. M. Cutler, 139 Macquarie St., Sydney, New South Wales.

RADIOLOGICAL SECTION OF THE VICTORIAN BRANCH OF THE BRITISH MEDICAL ASSOCIATION
Secretary, Dr. Colin Macdonald, Lister House, 61 Collins St., Melbourne, Australia.
Meets monthly at Melbourne during the winter.

SECTION ON RADIOLOGY, CANADIAN MEDICAL ASSOCIATION
Secretary, Dr. A. H. Rolph, 160 St. George St., Toronto, Ont.

RADIOLOGICAL SECTION, NEW ZEALAND BRITISH MEDICAL ASSOCIATION
Secretary, Dr. P. C. Fenwick, The Hospital, Christ-church.
Meets annually.

Continental Europe

BELGIAN SOCIETY OF ROENTGENOLOGY
Secretary, Dr. J. Boine, Avenue des Alliés, 134, Louvain (Belgium).
Meets monthly on second Sunday at d'Egmonds Palace, Brussels, except in the summertime.

SOCIETE DE RADIOLOGIE MÉDICALE DE FRANCE
Meets monthly on second Tuesday, except during months of August and September, 12 Rue de Seine, Paris.

SOCIÉTÉ SUISSE DE RADIOLOGIE (SCHWEIZERISCHE RÖNTGEN-GESELLSCHAFT)
Secretary for French language, Dr. A. Grosjean, La Chaux de Fonds.
Secretary for German language, Dr. Scheurer, Molzgasse, Biel.
Meets annually in different cities.

SOCIÉTÉ FRANCAISE D'ELECTROTHÉRAPIE ET DE RADIOLOGIE MÉDICALE
Meets monthly on fourth Tuesday, except during months of August and September, 12 Rue de Seine, Paris.

ASSOCIATION OF GERMAN ROENTGENOLOGISTS AND RADIOLOGISTS IN CZECHO-SLOVAKIA
Secretary, Dr. Walter Altschul, German University, Prague, II/52.

DEUTSCHE RÖNTGEN-GESELLSCHAFT (GESELLSCHAFT FÜR RONTGENKUNDE UND STRAHLENFORSCHUNG)
Meets annually in April, alternating one year in Berlin, one year in some other German city. Meets in addition every two years with the Gesellschaft deutscher Naturforscher und Aerzte.
Permanent secretary, Professor Dr. Haenisch, Klopstockstrasse 10, Hamburg, Germany.

SUD- UND WESTDEUTSCHE RÖNTGENGESELLSCHAFT
Meets annually in different cities.

NORD- UND OSTDEUTSCHE RÖENTGENGESELLSCHAFT
Meets annually in different cities.

DUTCH SOCIETY OF ELECTROLOGY AND ROENTGENOLOGY
Holds two meetings a year in Amsterdam, one in the Spring, and one in the Fall.

SOCIETA ITALIANA RADIOLOGIA MEDICA
Secretary, Professor M. Ponzio, University of Turin, Turin.

SOCIETATEA ROMANA DE RADIOLOGIE SI ELECTROLOGIE
Secretary, Dr. Nicolae Busila, 44 Elizabeta Blvd., Bucarest.
Meets second Monday in every month with the exception of July and August.

ALL-RUSSIAN ROENTGEN RAY ASSOCIATION, LENINGRAD, USSR in the State Institute of Roentgenology and Radiology, 6 Roentgen St.
Secretaries, Drs. S. A. Reinberg and S. G. Simonson.
Meets annually.

LENINGRAD ROENTGEN RAY SOCIETY
Secretaries, Drs. S. G. Simonson and G. A. Gusterin.
Meets monthly on the first Monday at 8 o'clock in the State Institute of Roentgenology and Radiology, Leningrad.

MOSCOW ROENTGEN RAY SOCIETY
Secretaries, Drs. L. L. Holst, A. W. Ssamygin and S. T. Konobejevsky.
Meets monthly on the first Monday at 8 o'clock, the place of meeting being selected by the Society.

POLISH SOCIETY OF RADIOLOGY
Secretary, Dr. A. Elektorowicz, 19 Hoza St., Warsaw.
Meets annually.

WARSAW SECTION, POLISH SOCIETY OF RADIOLOGY
Secretary, Dr. B. Krynski, 11 Zielna St.
Meets once a month except in the summertime.

SCANDINAVIAN ROENTGEN SOCIETIES
The Scandinavian roentgen societies have formed a joint association called the Northern Association for Medical Radiology, meeting every second year in the different countries belonging to the Association. Each of the following societies, with the exception of the Denmark Society, meets every second month except in the summertime:

SOCIETY OF MEDICAL RADIOLOGY OF SWEDEN
Meets in Stockholm.

SOCIETY OF MEDICAL RADIOLOGY IN NORWAY
Meets in Oslo.

SOCIETY OF MEDICAL RADIOLOGY IN DENMARK
Secretary, Dr. O. Wissing, Copenhagen.
Meets on the second Wednesday of each month from October to July in Copenhagen, at 8 o'clock in the State Institute of Roentgenology.

SOCIETY OF MEDICAL RADIOLOGY IN FINLAND
Meets in Helsingfors.

VIENNA SOCIETY OF ROENTGENOLOGY
Secretary, Professor Holzknecht, Vienna, IX, General Hospital.
Meets on the first Tuesday of each month from October to July.

COURSE FOR THE STUDY OF CANCER

The Faculty of Medicine of Strasbourg announce that they will offer a course on the study of cancer from July 16 to 26, 1930. The course has been organized under the patronage of Paul Strauss, senator, former Minister of Hygiene, Member of the Academy of Medicine, by Dr. Gunsett, director of the Anticancer Center of Strasbourg.

The tentative program includes: (A) Theoretical and practical courses on cancer in the different institutes and clinics of the Faculty of Medicine. These courses will be under the direction of Prof. Borrel who will discuss the tissue cultures, with practical work in this field, and also of Profs. Canuyt, Géry, Keller, Leriche, Pautrier, Reeb, Stolz, Vlès and Weill.

(B) Demonstrations and practical work of the Anticancer Center of Strasbourg (Dr. Gunsett). These demonstrations will include the methods of treatment by such physical agents as roentgen rays, radium and coagulation. In the discussion of roentgen rays will be taken up the demonstration of the principal modern apparatus for determination of dosage in French and international units, with a consideration of both superficial and deep dosage, and methods of application. Under "curie therapy" will be discussed the various forms of apparatus used together with method of application.

There will be daily presentations of new cases or cases under treatment.

The application for the course may be sent to Dr. Gunsett, director of the Anticancer Center, Hôpital civil à Strasbourg. The price of the course is 500 francs.

DINNER IN DR. BUTLER'S HONOR

All past and present students and associates of Dr. P. F. Butler of Boston, gathered at the Copley-Plaza Hotel in that city on the evening of January 25 at a dinner given in honor of their former "chief." The get-together followed immediately

after the Radiological Conference of the Eastern Seaboard Cities held at the Hotel Statler in Boston, January 24 and 25. In addition to the guest of honor the following were present: Dr. Frederick W. O'Brien, Dr. Max Ritvo, Dr. Alexander S. MacMillan, Dr. Samuel Robins, Dr. Albert Maloney, Dr. George Rafferty, Dr. W. S. Altman, and Dr. Charles Galligan, all of Boston; Dr. Michael Cox, Pittsfield; Dr. Constantine Popoff, Haverhill; Dr. Sam Atkins, Waterbury, Conn.; Dr. N. G. Butler, Hartford, Conn.; Dr. Joseph Elward, Washington, D. C.; Dr. Anatole Desjardins, Wilkes-Barre, Penn.; and Dr. J. E. Habbe, Milwaukee, Wis.

The group informally organized themselves into the P. F. Butler Association and in the future, notes of Dr. Butler's weekly clinical-roentgenological conferences will be mailed to each member. Following the dinner and speech-making, the guest of honor was presented with a gold watch and chain as a token of appreciation. It was planned to make the get-together dinner an annual affair.

MINNESOTA RADIOLOGICAL SOCIETY

An organization of radiologists, to be known as the Minnesota Radiological Society, was recently formed. The first formal meeting was held at Rochester, Minnesota, March 1, 1930. The following program, arranged by Dr. B. R. Kirklin, was presented: "Roentgenologic Manifestations of Malignant Disease in the Colon" by H. M. Weber; "Gastrojejunal Ulcer" by J. D. Camp; "Roentgen Studies on Tuberculous Spine in Children" by R. K. Ghormley; "Mediastinal Empyema" by Jacob Sagel; "Roentgen Diagnosis of Small Pleural Effusions" by L. G. Rigler; "Specific Radiosensitiveness of Cells and its Significance to Radiotherapy" by A. U. Desjardins; "A Radium Technique in the Treatment of Carcinoma of the Cervix Uteri" by R. E. Fricke; "Results Obtained from Radiation Therapy in Cases of Carcinoma of the Cervix Uteri" by H. H. Bowing; "Use of Iodized Oil in Gynecological Diagnosis" by L. M. Randall; "Preliminary Report of Intravenous Urography by Means of Uroselektan" by C. G. Sutherland and W. F. Braasch.

The Secretary of the society is Dr. L. G. Rigler of Minneapolis. The next meeting will be held in Duluth, Minnesota, on July 14, 1930.

INDIANA ROENTGEN SOCIETY

The third annual meeting of the Indiana Roentgen Society was held in Indianapolis on February 22, 1930. Dr. A. B. Moore of Rochester, Minn., addressed the meeting. The following officers were elected: President-elect, L. A. Smith, Indianapolis; Vice-president, A. C. Holly, Attica, Ind.; Secretary-Treasurer, J. N. Collins, Indianapolis.

Vol. XXIII, No. 4

DEPARTMENT OF TECHNIQUE

Department Editor: David R. Bowen, M.D., Pennsylvania Hospital, Philadelphia, Pa.

EQUIPMENT FOR ENCEPHALOGRAPHY

By FREDERIC SCHREIBER, M.D.
Harper Hospital
DETROIT, MICHIGAN

ENCEPHALOGRAPHY entails numerous and necessary shifts in the position of the patient. These changes in position must be gently accomplished to avoid breaking or shifting the lumbar puncture needle when in place. The whole procedure is carried out in the roentgen department since the less the patient is moved about after the air injection, the less will he complain of headache and nausea.

The apparatus described here has been found useful in avoiding some awkwardness in handling these patients (Fig. 1). It consists of a special bench, chair and stool. The bench is so constructed that the central third of the top is removable and rests on rollers. This separate piece is also used interchangeably as the seat of the chair and can easily be slid from one to the other, since both bench and chair are of the same height.

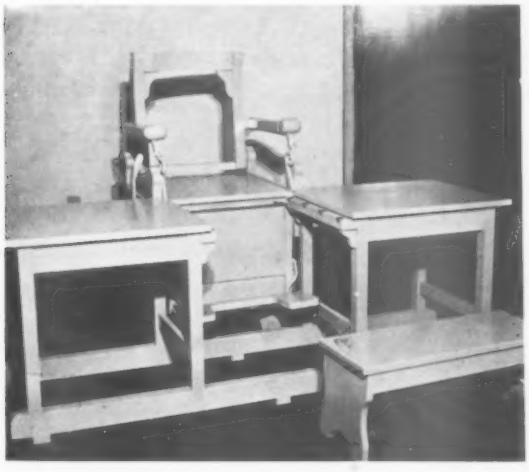

Fig. 1. Showing chair, bench and stool used for encephalography. The sliding portion of the bench is here shown in place as the chair seat.

Fig. 2. The patient in position for lumbar puncture. Note the three pillows and the relation of the hips to the sliding portion of the bench.

The patient is seated on a pillow over the sliding portion of the bench. Without changing his position laterally, he is laid on the bench, ready for lumbar puncture (Fig. 2). The needle is inserted and manometer readings taken. The manometer is then disconnected and the stylet reinserted in the lumbar puncture needle. With the needle left in place, the patient is then set up in his original position. The movable seat with the patient on it is then rolled from the bench onto the chair and every-

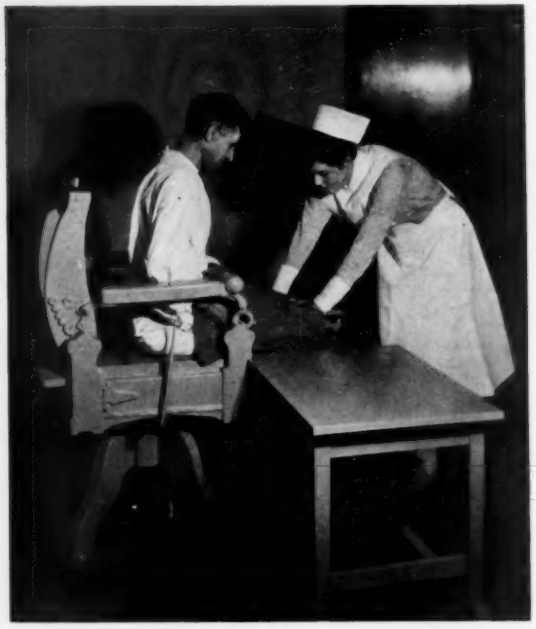

Fig. 3. The patient having again assumed a sitting position is being pushed back into position on the chair.

Fig. 4. Patient in position for the injection of air. The instruments and containers are on the shelf below the open chair back. The nurse rotates the patient's head to insure even distribution of air.

Fig. 5. The chair in position for the anteroposterior view. The Bucky diaphragm is tilted slightly forward and is steadied by resting it on the back of the chair.

thing is in readiness for the air injection (Fig. 3).

The chair is solid in construction and is fitted with castors which can be clamped to the floor. A board is laid over the arms of the chair so that the patient's elbows are supported, and his back is arched. The operator sits on a stool behind the open-backed chair with his instruments placed before him on a convenient shelf. A nurse supports and rotates the patient's head, tapping it from time to time to insure freedom from bubbles in the foramina, and an even cortical distribution of air (Fig. 4).

After a sufficient amount of air has been injected, the chair is moved into position and firmly clamped to the floor preparatory to making the encephalograms. The Bucky diaphragm is steadied by resting it on the chair, thus avoiding the slight vibration when the trigger is pulled. For taking the films, the chair can be revolved, tilted and locked in any position. The

backward tilt is especially useful in outlining the third ventricle.

Since using this apparatus we find that our encephalograms can be made much more rapidly and that the patients complain less of nausea and headache.

No doubt numerous chairs for similar purposes are in use but we believe that this chair and accessories combine certain features which are advantageous.

BOOK REVIEWS

Books Received Are Acknowledged under Heading: Books Received. This must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

Röntgenuntersuchungen am Innenrelief des Verdauungskanals. Ein Beitrag zur klinischen Röntgendiagnostik insbesondere von Entzündung, Geschwür und Krebs. Von Dr. Hans Heinrich Berg, A. O. Professor an der Universität Berlin, Oberarzt der z. Medizin. Universitätsklinik der Charité. Paper, price 27 Marks; bound, price 29 Marks. Pp. 198, with 193 illustrations. Leipzig: Georg Thieme, 1930.

Irregularities in the shadow of the bismuth-filled stomach attributed to folds in the mucosa were observed early in the history of roentgenology but until recently they have been mentioned in the literature only casually, if at all. The study of the mucosa of the gastrointestinal tract has its foundation in the important work of Prof. Gösta Forssell. He has shown that, instead of being anatomically fixed, it is a very movable, flexible structure with a constantly changing contour which is modified by nervous influences and disease processes. This book is an exposition of the roentgenologic method of studying the mucosa and of its possibilities and limitations in the detection of disease. Its title may be freely translated, "The Roentgen Investigation of the Mucosal Relief Contours of the Digestive Tract."

The book is divided into ten sections. After a historical introduction in the first, the second, third and fourth deal with technical methods of demonstrating the mucosal contours, their physiologic background and their normal appearance in the various parts of the gastrointestinal tract. The fifth discusses pathological and functional changes in the lining membrane. The sixth and seventh give the results of relief studies—largely by means of illustrative cases. The eighth, ninth and tenth sections present a criticism and evaluation of this method of diagnosis, and the bibliography.

To show up the mucosal contours, the lining membrane must be coated with a fairly thin layer of opaque material, in contrast to the usual method of filling the viscus completely and studying its profile. Berg has found that a water suspension of barium sulphate, while not ideal, is more satisfactory than other preparations. He gives only a small quantity—one to five swallows—which is spread over the gastric and duodenal mucosa by palpation and by changing the position of the patient. Pressure is applied sufficient to bring out the mucosal contour to the best advantage; this Berg calls "dosed pressure" and emphasizes repeatedly its importance. Careful roentgenoscopy is the cornerstone of the examination, and films are taken under screen control at the optimum moment. Not more than six cases, in Berg's opinion, should be handled in one day by one examiner to secure the most accurate results. The mucosal contours of the large intestine are best shown after the evacuation of a barium enema.

The study of the contours of the lining membrane with a small quantity of opaque material will give information not obtainable after complete filling of the viscus, and in the hands of an experienced examiner it is probably sufficient, in Berg's opinion. In general, however, he recommends that it be supplemented by the usual profile study after complete filling.

Many experienced roentgenologists begin their study of the stomach and duodenum with the brief manipulation of a swallow or two of the opaque mixture to demonstrate flexibility, mucosal folds, posterior wall craters, etc. Berg has gone far with this part of the examination and has recorded many interesting observations. He has produced an interesting, stimulating book, and although at times he treads on debatable ground, as in his discussion of gastritis, he has wisely tempered his enthusiasm with a healthful spirit of conservatism.

ROSS GOLDEN

Gall-Bladder Disease: Roentgen Interpretation and Diagnosis. By David S. Beilin, B.S., M.D. Roentgenologist, Augustana Hospital, Chicago, Ill. Cloth. Price, $6.00. Pp. 65, with 130 illustrations. St. Paul, Minn.: Bruce Publishing Co., 1929.

This volume has been produced, as the author states, in an attempt to coordinate the fundamentals of our present knowledge of the biliary system into concise and practical form.

He has done this with a brevity which we think will appeal to the average worker.

The portions on anatomy, physiology and pathology are somewhat sketchy, although quite adequate for purpose of review. The sections devoted to cholecystography are sufficiently detailed and inclusive to illustrate the cases with which we are likely to be concerned. They present nothing particularly new, but known types of cases are well illustrated and explained in relation to the clinical, roentgenologic and operative findings.

Dr. Beilin's experience with the oral administration of the dye has led him to deal wholly with this procedure. Of course the literature abounds in articles on intravenous technique and interpretation of findings, yet we should consider the work a little more valuable had some details of this widely used method been included. The correctness of the author's diagnoses is remarkable, there being only 2 per cent error in proved cases. However we find no statement regarding the total number of examinations on which the statistics are based.

The reproductions of roentgenograms are good and they are grouped on large pages in such a manner as to facilitate comparative study. The book is easily read due to brevity of statement, excellent arrangement and clear, large type. We commend it to all interested in gall-bladder diagnosis.

E. W. Hall

Books Received

X-ray Technology. The Production, Measurement and Applications of X-rays. By H. M. Terrill, Ph. D., Associate in Physics, Institute of Cancer Research, and C. T. Ulrey, Ph. D., Research Physicist, Westinghouse Lamp Company. Cloth. Price, $4.50. Pp. 256, with 143 illustrations. New York: D.Van Nostrand Company, Inc., 1930.

Roentgenographic Technique. A Manual for Physicians, Students, and Technicians. By Darmon Artelle Rhinehart, A.M., M.D. Professor of Roentgenology and Applied Anatomy, School of Medicine, University of Arkansas; Roentgenologist to St. Vincent's Infirmary, Baptist State Hospital, Missouri Pacific Hospital, and the Arkansas Children's Hospital. Cloth. Price, $5.50. Pp. 388, with 159 illustrations. Philadelphia: Lea and Febiger, 1930.

La Sensitometrie Cutanee. Introduction à l'actinothérapie rationelle. By J. Saidman, Directeur-Fondateur de l'Institut d'Actinologie. Paper. Price, 60 francs. Pp. 294, with 82 illustrations in the text and four colored plates. Paris: Gaston Doin et Cie, 1930.

Tuberculosis in Public School Children. From the Henry Phipps Institute of the University of Pennsylvania under a grant from the Metropolitan Life Insurance Co. Cloth. Reprinted from the *American Review of Tuberculosis*, October, 1929, *20*, 413–636.

The Health-Care of the Baby. A Handbook and Feeding Guide for Physicians, Mothers, and Nurses. By Louis Fischer, M.D., Author of "A Text-book on Diseases of Infancy and Childhood"; "Infant Feeding in Health and Disease"; "The Health-care of the Growing Child"; Consulting Physician to the Willard Parker and Riverside Hospitals, etc. Eighteenth edition revised. Cloth. Price, $1.00. Pp. 268, with illustrations. New York: Funk and Wagnalls Co., 1930.

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ABSTRACTS OF ROENTGEN AND RADIUM LITERATURE

ROENTGEN DIAGNOSIS

HEAD

Lyon, Ernst, and Marum, Gottlieb. Die Schüllersche Krankheit. (Christian's syndrome.) (Schüller's disease. (Christian's syndrome).) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, Sept., 1929, *40*, 463–467.

The primary disturbances of lipoid metabolism are: (1) the splenohepatomegaly of Gaucher, the so-called Gaucher's disease, occurring chiefly in more advanced age; (2) the splenohepatomegaly of Niemann-Pick, in which on account of the very fast progress of the disease death occurs within the first two years of life, and (3) Schüller's disease, or the condition known in America as Christian's syndrome. Only 16 cases of this latter are recorded in the literature.

Rowland in a more recent communication, entitled "Xanthomatosis and the Reticulo-endothelial System (Christian's Syndrome)," placed all three of the above conditions under the general heading of "xanthomatosis," while Pick still maintains that the three variations should not be considered as a reticulo-endothelial "systemic" entity since both in Gaucher's disease and Niemann-Pick's disease the endothelial cells play no part.

The purpose of this article is to describe the course in one of the cases originally described by Schüller so as to allow certain deductions with regard to the true nature of the disease.

The case is that of a girl born in 1909 of Jewish parents, who at the age of two developed a rather prominent exophthalmos of the left eye with defects of the bones of the skull. Six weeks later the child started to drink considerably and a protrusion of the right eye followed. In a first communication (October, 1913) the child was described as small and delicate with rather marked anemia and very pronounced polyuria (8 liters daily). There was exophthalmos of both eyes and the skull presented defects of various sizes (from the size of a penny to the size of a palm).

Re-examinations, in 1914 and 1915, by Schüller revealed a diminution in the size of the defects of the bones of the skull although the polyuria and exophthalmos remained unchanged. At this time Schüller described the presence of diabetes insipidus, the bone defects of the skull and a marked exophthalmos as the most characteristic signs of the disease.

The patient was seen again several times between 1924 and 1929 and it was found that the bone defects had practically disappeared but that the exophthalmos and polyuria persisted.

The first roentgenograms in the case date back to 1913 when there was evidence of a "peculiar geographical spotting of the shadow of the skull," the changes being localized chiefly to the external table. There was an erosion of the supraorbital margins and from this it was concluded that the exophthalmos was secondary to the destruction of the bone. Roentgen examination was repeated in 1914, 1915, 1924 and 1929. The last films revealed that the formerly observed bone defects have entirely disappeared and that the orbit has reassumed its normal appearance (the exophthalmos continuing in spite of this). The only changes were in connection with the sella turcica in that the dorsum sellae was somewhat higher and the posterior clinoid processes did not show on the roentgenograms.

The marked feature of the case was the remarkable improvement in the general condition of the patient (observed also in one of Rowland's cases) in spite of the persistence of the polyuria and exophthalmos. The bone defects of the skull gradually disappeared, the only permanent changes being the lack of the posterior clinoid processes and the reclination of the dorsum sellae. Thus it appears that the condition, similar to Gaucher's disease, is of long duration and of a practically benign nature. Nothing is known as yet with regard to the importance of heredity, although the condition is familial and seems to affect principally the Jewish race.—*T. Leucutia.*

Weber, G. Ein Beitrag zur kritischen Deutung enzephalographischer Befunde. (A contribution to the critical discussion of encephalographic findings.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, Sept., 1929, *40*, 437–447.

Encephalography has been used routinely in the Frankfurt Kinderklinik since 1923. In several instances encephalograms were made at different intervals for check-up observations, and in connection with this it was noted that the findings of the different examinations failed to coincide. The investigations revealed that this may be attributed to artefacts.

Seven cases are described in detail and their roentgenograms are presented, proving (1) that in pathological brains, artefacts may be due (*a*) to change in position of the head during the taking of the roentgenogram, (*b*) to incomplete withdrawing of the cerebrospinal fluid, (*c*) to possible form and position changes of the brain due to enlargement of the fluid spaces and cerebral atrophy; (2) that in normal brains artefacts may be obtained from shifting of the air as a result of changes in position or motion during the actual taking of the roentgenograms.

In several of the cases repeated examinations after submitting the children to various passive motions still failed to reveal a normal distribution of the gas.

The conclusion is reached that encephalograms in children must be interpreted very carefully since normal conditions may often lead to a distribution of the gas within the fluid spaces simulating disease.—*T. Leucutia.*

Balestra, G. Contributo alla conoscenza del quadro radiologico della tubercolosi della volta cranica. (Tuberculosis of the vault of the skull.) *Arch. di radiol.*, May–June, 1929, 7, 515–520.

A case is described in a child eighteen months of age with a severe tuberculosis taint in the family. The Wassermann reaction was negative in the child and the tuberculin test strongly positive. There was a circumscribed tuberculous osteitis of the frontal bone. The focus appeared in the roentgen picture as an oval lacuna involving the whole thickness of the bone; it had very distinct outlines as if cut out with a punch and there were no shadows of sequestra in it. The bone around it was apparently normal. This picture is rarely seen in tuberculosis of the skull and though it may be seen in other conditions too and is not easy to interpret the author thinks the possibility of its being seen in tuberculous osteitis should be borne in mind, particularly as it is hard to diagnose early forms of this disease clinically.—*A. G. Morgan.*

Nicotra, A. La calcificazione e l'osteoma della falce del cervello, al controllo anatomo-radiologico e clinico. (Calcification and osteoma of the falx cerebri; clinical, anatomical and roentgen study.) *Arch. di radiol.*, July–Aug., 1929, 7, 794–823.

The author has examined 400 clinical cases and made roentgenograms in various projections. Among these were 25 patients with no lesions of the sinuses or meninges. One case was confirmed by autopsy. He opened the skulls of 200 bodies to determine the percentage and type of calcifications in the falx. He made roentgenograms in the occipito-frontal and the two other usual projections in 40 of the 200 cadavers examined. He made roentgenograms in the occipito-frontal direction of 64 macerated skulls to study the roentgen appearance of the frontal crest independently of the presence of the falx cerebri, controlling his roentgen findings by opening the skulls. He studied the roentgen appearance of calcifications of the falx cerebri in the two forms of osteoma and granular calcification and produced these two forms experimentally. In a vast anatomical material he studied the roentgen appearance of the crest and the falx cerebri.

Among the 400 roentgenograms in the occipito-frontal direction he found an opaque medio-frontal line in 31, or about 8 per cent. This percentage is high in proportion to the anatomical percentage of calcifications of the falx. Among the 200 cadavers examined he found calcifications in only 3. These calcifications were all in the form of very small lenticular osteomas a few millimeters in diameter which in only one case showed a small paramedian roentgen shadow, barely perceptible on the roentgen negative. His study of 400 clinical cases led him to interpret only 3 as calcifications of the falx. This was less than 1 per cent as compared with the 8 per cent of opaque medio-frontal lines in the occipito-frontal roentgenograms. In 28 of the 31 cases in which this line was found it was to be interpreted in 22 as a hypertrophied frontal crest and in 3 as parasutural hyperostoses in an incompletely fused frontal suture.

Clinically the finding of calcification of the falx is of some importance. It indicates a search for active or old inflammatory processes. He believes it is rare and the opaque medio-frontal line in most cases is due to projection of

a hypertrophied frontal crest or an incompletely fused suture. When an opaque medio-frontal line appears as a straight line with pointed ends and continuous, and not visible in the other projections, especially the oblique and lateral ones, it is to be interpreted as a moderately hypertrophied crest. A beak-shaped crest indicates extreme hypertrophy. A diagnosis of calcification must be made by stereograms or the demonstration that the line is seen in the lateral, and particularly the oblique projections. In a projection at 45° it is often possible to differentiate between the shadow of the calcification and that of the crest. A thorough knowledge of the interpretation of the medio-frontal line in the roentgen picture will be of great value in clinical conclusions in regard to calcifications of the falx.—*A. G. Morgan.*

Grudzinski, Zygmunt. Neue vereinfachte graphische Methode zur genauen Röntgenlokalisation metallischer Fremdkörper im Auge. (Schema-Auflage-Methode.) (A new simplified graphic method for the exact roentgen localization of metallic foreign bodies in the eye.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, Sept., 1929, *40*, 468–474.

The method is a simplification and perfection of the Holzknecht and Altschul methods for the localization of foreign bodies in the eye. It consists of two procedures: (*a*) the taking of roentgenograms under certain well-established conditions, and (*b*) the determination of the position of the foreign body by means of transparent charts.

(*a*) Four roentgenograms are taken, with the eye looking upward, downward, to the right and to the left. The angle of rotation of the eye is 27.5° in each instance and the film focus distance is 60 cm. A cross with equal arms (of 50 cm. length) and with white ringmarks at the ends of each arm is used for sighting. After the immobilization of the head in the lateral position, the patient first looks straight ahead and the cross is placed with its center exactly 96 cm. from the center of the cornea. Then the patient looks to each white ringmark of the cross (the angle of vision under these circumstances corresponding to 27.5°) and successive roentgenograms are taken.

(*b*) For the localization, the image of the foreign body on the film taken with the eye looking downward is superimposed on the film with the eye looking upward and the image of the foreign body of the film with the eye looking to the right is superimposed on the film with the eye looking to the left. Then a transparent celluloid or paper diagram of the sagittal section of a normal eye is placed over the roentgenogram with the eye looking upward-downward in such a manner that the normal axis of the eye is perpendicular to the axis of the schematic eye of the diagram. The foreign body of the film looking downward is marked with red ink exactly in the center of the eye of the diagram and the foreign body of the film looking upward at the corresponding distance and location from the center of the eye.

The same procedure is repeated with the roentgenograms looking to the right and left, with exception that here a diagram of a horizontal section of the eye is placed over the films and the shadow of the foreign body looking to the left is marked in the center of the eye of the diagram.

Diagrams so obtained are then transposed on a chart and the position of the foreign bodies graphically plotted.

The sources of error are: (1) extra-ocular foreign bodies lying near the posterior half of the eyeball; (2) foreign bodies in the center of the eye, and (3) the foreign bodies of extremely large or small eyeballs.

The first two errors may be corrected by taking a film in a lateral position with the vision straight forward and with a landmark on the cornea, or, still better by a control examination in the posteroanterior view. For the correction of the third error diagrams of eyes of different sizes would be necessary.

The method is as accurate as one may expect for a localization which can be done within the short time of one or two minutes.—*T. Leucutia.*

NECK AND CHEST

Guenaux. Un cas de diverticule épi-phrénique de l'oesophage. (A case of epiphrenic diverticulum of the esophagus.) *Bull. et mém. Soc. de radiol. méd. de France*, June, 1929, *17*, 165–167.

There are three types of esophageal diverticula: (*a*) the upper, or pharyngo-esophageal; (*b*) the middle, or epibronchial, and (*c*) the lower, or epiphrenic.

The author describes a case of an epiphrenic

diverticulum of the esophagus in a woman fifty-two years of age who presented rather indefinite symptomatology, such as occasional pain, dysphagic symptoms, etc. The diverticulum had the shape and size of a hen's egg and was lying vertically on the diaphragm.

It is mentioned in connection with this that the diverticula of the lower and upper portions of the esophagus are as a rule rather large, while the epibronchial diverticula are always small.—*T. Leucutia.*

Bagnaresi, G. Sull'aneurisma latente dell' aorta toracica. (Latent aneurysm of the thoracic aorta.) *Arch. di radiol.*, May–June, 1929, *7*, 521–534.

A case of latent aneurysm of the thoracic aorta is described in a man aged forty-six. Some of the clinical and roentgen findings indicated a diagnosis of echinococcus cyst. But the roentgen demonstration of extensive erosion of some of the dorsal vertebrae confirmed the diagnosis of aneurysm. The author emphasizes the value of roentgen examination of the spinal column for the purpose of demonstrating the lesions of the vertebrae that often occur in aneurysm of the thoracic aorta.—*A. G. Morgan.*

Rösler, H. Röntgenologische Untersuchungen über die Herzgrösse bei Herzschlagverlangsamung. (Roentgenologic investigations on the size of the heart in bradycardia.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, September, 1929, *40*, 519–522.

Eighteen cases of bradycardia were examined by means of orthodiagraphy in the erect posture with regard to the size of the heart and in some instances to the amplitude of the systolic-diastolic excursions. The disturbance in the rhythm of the heart was determined by the electrocardiograph.

The cases were divided into two groups: A. Seven cases in which in addition to the bradycardia there was evidence of other pathological conditions leading to increase in size of the heart (in 3 hypertonia with signs of coronary sclerosis; in 2 hypertonia alone, in one mesaortitis luetica and in one luetic insufficiency of the aortic valves). B. Eleven cases without complications.

The disturbance in the rhythm of the heart in the cases examined consisted of partial or complete heart block and of nodal rhythm.

In both groups there was evidence of increase in size of the heart. The pulsatory excursions were also markedly increased, in the cases of partial and complete heart block the increase being confined to the left and in nodal rhythm to the right margin of the heart.

An enlargement of the left auricle could not be observed in the uncomplicated cases.

The enlargement of the heart occurs regularly whenever the disturbance in the rhythm extends over a period of several years and is more pronounced in the partial and complete heart block than in the nodal rhythm.—*T. Leucutia.*

Kienböck, Robert, and Weiss, Konrad. Über das entzündliche Perikard-Divertikel. (Inflammatory pericardial diverticulum.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, September, 1929, *40*, 389–418.

Three cases of inflammatory pericardial diverticulum are described in detail. The first case is that of a woman thirty-nine years of age who first came under observation in 1908, with a marked chlorosis, general debility, pain in the right chest, dyspnea and marked palpitation of the heart. The roentgen diagnosis at that time was sac-like aneurysm of the ascending aorta. The case was re-examined in 1914 and again in 1919, the diagnosis remaining in both instances the same. At a fourth examination a few months later, in another institution, the diagnosis was changed to intrathoracic tumor and at a fifth examination in 1924 to solitary aneurysm of the ascending aorta. Finally, in 1927, after the experience with Case III the correct diagnosis of pericardial diverticulum was established.

The second case is that of a man, thirty-three years of age. He was examined in 1920 but a definite diagnosis could not be made at that time.

The third case is that of a woman, thirty-seven years of age, who was examined recently and who in fact is responsible for the recognition of the true nature of the disease. This woman had a symptomatology very similar to that of the first case and the roentgen examination of the chest presented a picture which was variously classified as pericardial exudate, mediastinal tumor and aneurysm of the aorta. Following her death an autopsy was obtained and this revealed a pericardial diverticulum due

to adhesions from a chronic fibrous pericarditis.

Subsequently, the authors compared the roentgenogram of Case III with those of Cases I and II and found such a striking similarity, that on the basis of this they felt justified in changing the former diagnosis of those cases to that of pericardial diverticulum.

The condition is exceedingly rare. A review of the literature reveals that there are several anatomico-pathological reports which may be considered more or less characteristic of pericardial diverticula, but that there is only one clinico-roentgenological report, that of Seidler (1921) in which an accurate description of the condition was given in vivo. A correct diagnosis, however, could be established in this case only after the post-mortem examination.

In another case, that of a physician forty-five years of age, observed by Herz, and in which a previous diagnosis of dermoid cyst was made, the condition was recently classified as pericardial diverticulum. These constitute the only cases recorded in the literature.

The roentgen signs of a pericardial diverticulum are either (*a*) positive, consisting in (1) diffuse enlargement of the heart and (2) an abnormal shadow (diverticulum) at the right border of the heart, or (*b*) negative, consisting in (1) normal contour of the aorta, (2) normal appearance of the lungs, and (3) a lack of change of the positive signs in subsequent roentgenologic examinations.

The abnormal shadow at the right border of the heart which really constitutes the diverticulum is as a rule the size of an apple, of rounded contour and, with the exception of a very small zone of increased transparency at the margin, of homogeneous density. It follows the excursions of the diaphragm during respiration and shows a very slight pulsation.

Differential diagnosis includes (1) simple enlargement of the heart; (2) aneurysm of the aorta; (3) mediastinal tumor, and (4) encysted pleural exudate. Inflammatory pericardial diverticula occur subsequent to chronic fibrous pericarditis and as a result of extensive adhesions.—*T. Leucutia.*

Conrozier, and Magnin. La silicose pulmonaire. (Pulmonary silicosis.) *Bull. et mém Soc. de radiol. méd. de France*, June, 1929, *17*, 206–207.

Two cases of pulmonary silicosis are briefly described, and in connection with this the association with tuberculosis discussed.—*T. Leucutia.*

Stirpe, Giulio. Aspetti radiografici del polmone opposte al pneumotorace artificiale terapeutico e loro valore a fianco ed in confronto dell'esame clinico. (Roentgen appearances of the lung on the side opposite an artificial therapeutic pneumothorax and their value in themselves and in relation to clinical examination.) *Arch. di radiol.*, July–Aug., 1929, *7*, 647–675.

The author studied the roentgen appearance of the lung on the side opposite artificial pneumothorax in patients with unilateral pulmonary tuberculosis, making series of roentgenograms before the pneumothorax was begun, after the first application of the pneumothorax and after complete collapse of the diseased lung. Eight cases are described and illustrated by roentgenograms. In all the cases there were roentgen changes in the normal lung, consisting of increased clearness and distinctness of the lung outline; this began in some subjects after the first insufflation of air. This increased distinctness of the lung outline is due to greater fullness of the arteries of the lung on the normal side resulting from the collapse of the opposite lung. If it is followed up by series of roentgenograms it is found to increase as the collapse of the diseased lung becomes more complete. Another possible factor is vicarious emphysema of the normal lung, though some authors deny this, as the greater clearness of the lung outline can be seen in cases in which there is not any marked displacement of the mediastinum.

The author emphasizes the importance of knowing of these changes so that they may not be interpreted as pathological. He intends to follow up the study, comparing the findings with the clinical findings in the diseased lung, as he thinks these pictures may be of value in the prognosis of the treatment.—*A. G. Morgan.*

Gianturco, C. Il lobo della vena azygos alla indagine radiologica. (The lobe of the azygos vein in the roentgen picture.) *Arch. di radiol.*, July–Aug., 1929, *7*, 745–757.

Anatomists have long known that there may be a supernumerary lobe of the right lung from division of the upper lobe into two parts by a deep vertical incisure. The smaller and median

part of this divided lobe is called the lobe of the vena azygos because that vein runs beneath the incisure and instead of emptying directly into the trunk of the vena cava describes a loop which passes around the base of the new lobe. The anatomy of the azygos vein is reviewed and sketches given of its course when there is an accessory lobe.

The condition is rare and hundreds of roentgen examinations may be made without seeing a case, but the author has seen 3 and gives roentgenograms of these and of some others sent him by colleagues. It may give pictures that cause mistakes in diagnosis. The interlobar incisure should always be visible but in poor pictures it sometimes is not and the dense shadow of the vein may be mistaken for an infiltrated or calcified lymphatic gland. And the picture may be simulated by other conditions; for instance, the interlobar incisure may be simulated by the edge of annular bronchiectases at the apex, of cavities, of spontaneous circumscribed pneumothorax or emphysema. Careful observation should be made to see if the internal and external ends of the interlobar fissure are of the same density, if the structure of the lung parenchyma is normal and if the dense shadow of the vein lies immediately below the incisure. Examination for the azygos lobe should be made exactly in the anteroposterior direction as otherwise it may be obscured by the vena cava, the brachiocephalic trunk or the spinal column. It is very hard to make a differential diagnosis between an azygos lobe that has undergone pathological changes and other causes of opacity of the apex. The changes which take place in the accessory lobe are as a general rule the same as those that occur in the rest of the lung; changes in the parenchyma may obscure the picture of the accessory lobe but sometimes they make the incisure even more visible and so facilitate diagnosis.—*A. G. Morgan.*

Podesta, V. Corpi estranei nelle vie bronchiali. (Foreign bodies in the bronchi.) *Arch. di radiol.*, May–June, 1929, *7*, 535–552.

Six cases are described in which foreign bodies were localized in the bronchi by roentgen examination. The author thinks roentgen examination is beyond doubt the best method for localizing such foreign bodies. It not only shows the presence and location of a foreign body, either opaque or transparent, but also shows the lesions in the respiratory tract caused by it. It is very much to be preferred to simple bronchoscopy both because it permits of more accurate localization and because it is much less disturbing to the patient, for the general condition of these patients is often very bad. When the foreign body is transparent to the rays the diagnosis must be based on indirect signs, such as decreased mobility of the diaphragm on the affected side and aspiration of the mediastinum toward the side of the lesion. Foreign bodies which penetrate the bronchi often cause serious general and local disturbances and sometimes death but sometimes they remain indefinitely in the bronchi without causing any great disturbance. There may be no general or local atelectasis of the lung and if there is it generally disappears as soon as the foreign body is expelled or removed by surgical operation. Expectorants and antispasmodics should be given to help expel the foreign body and allay the irritation caused by its presence; bromoform is among the most effective of these.—*A. G. Morgan.*

Bronkhorst, W. Die Röntgentechnik der Lungenaufnahme. (Roentgen technique of lung pictures.) *Acta radiol.*, 1929, *10*, 254–270.

The technique of roentgenography of the lungs, especially with reference to contrast and sharpness of the pictures, is discussed. In connection with several curves taken from a former work of the author the influence of different factors on the contrast qualities is considered. Special importance is attached to the intensity of the exposure, the tension of the primary rays, the use of intensifying screens and of the diaphragm for secondary rays. The importance of the size, shape and homogeneity of the focus is demonstrated.—*A. G. Morgan.*

ABDOMEN

Sandström, Carl. Über die orale Darreichung und die Röntgentechnik bei Cholecystographien. (The oral method and roentgen technique in cholecystography.) *Acta radiol.*, 1929, *10*, 271–290.

The author describes the method of giving the contrast medium by mouth in cholecystography, a method that has been in use at the Maria hospital in Stockholm for the past year

and a half and has given much better results than the method of oral administration formerly in use. Instead of using the contrast medium in pill or capsule form it was given as an emulsion as suggested by Fantus. Ordinary soda water has been used with advantage in precipitating the contrast salt. To attain the best absorption of the salt it is necessary for the intestine to be at rest and not irritated, and for this reason laxatives should not be given before the examination. The intestine should be fairly empty, so the patient should eat less than usual on the day of taking the emulsion. The last meal should be about four hours before the emulsion.

In most cases the usual technique of making survey pictures of the gall-bladder region is not sufficient. The patient should always be examined standing with combined screening and roentgenography. With this technique the contrast-filled gall-bladder can easily be seen on the screen. After getting the patient in the best position, small detail pictures are made of the gall-bladder, and it is particularly advisable to take series of pictures, as in examining the bulb of the duodenum. It is also important to graduate the compression, under screen control, so that the contrast shadow forms a thin layer, the details of which are easily analyzed. In this way very small isolated concrements have been demonstrated. With this technique it is an advantage, rather than the opposite, if the shadows are not so dense as they usually are after an intravenous injection of the contrast medium.

When an obstruction is suspected in the common duct, roentgen examination of the size of the spleen may be of value in some cases. It seems quite probable, from the author's material, that if the spleen is normal in size the common duct is not obstructed. With this technique cholecystography with the contrast medium given by mouth is as reliable as that after intravenous injection. Twelve roentgenograms are given, all but one of them taken with this technique.—*A. G. Morgan.*

Podestà, V. L'indagine radiologica nelle sindromi tifloduodeno-colecistiche. (The roentgen picture in associated appendicitis, duodenitis and cholecystitis.) *Arch. di radiol.*, July–Aug., 1929, *7*, 692–744.

Eight cases are described and illustrated with roentgenograms. They show that whatever the physiological, anatomical and pathological relationship between the large intestine and appendix on the one hand and the stomach, duodenum, liver and bile tract on the other, lesions of the appendix are not infrequently associated with lesions of the stomach and duodenum or cholecystitis. The lesions may be of any degree from simple gastro-duodenitis and periduodenitis to gastric or duodenal ulcer and from simple retention of bile to cholecystitis and pericholecystitis or bile calculi.

The author then discusses the value of roentgen examination in such cases. In the first place it eliminates possible lesions of other organs which cause a similar symptomatology, such as disease of the kidneys or elsewhere in the urinary tract, and even other conditions in the digestive tract, such as movable cecum, etc. And in the second place it may give positive signs of the condition that actually exists, such as shadows of bile calculi, signs of gastric or duodenal ulcer, evidence of lesions of the appendix, evidence of cholecystitis or pericholecystitis and anomalies in position and function of the cecum and large intestine.

It is true that gallstones cannot always be demonstrated roentgenologically, but the diagnosis may be made even in such cases from indirect signs, such as deformity of the bulb of the duodenum and inability to inject the gall-bladder even by Graham's method. Roentgen diagnosis of ulcer of the stomach or duodenum is certain when there is a niche but it may be doubtful in other cases. The same thing may be said of simple appendicitis and cholecystitis and roentgen examination may in some cases even make the diagnosis more obscure instead of clearing it up. But inflammation around the gall-bladder, pylorus, duodenum or appendix can generally be diagnosed quite easily by roentgen examination.

In other cases roentgen examination shows lesions of different organs. For example a patient may be sent for examination for appendicitis and the findings may show not only this condition but also gallstones. In such cases the roentgen examination cannot show the nature of the relationship between the two conditions but it at least shows that inflammations of the appendix, duodenum and gall-

bladder are frequently associated.—*A. G. Morgan.*

Golonsko, R. Über Funktionsstörungen des Dickdarmes bei Perikolitis. (Functional disturbances of the colon in pericolitis.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, September, 1929, *40*, 508–512.

The etiologic factors of the functional disturbances of the colon may be classed into two main groups: (1) those without anatomical foundation, and (2) those with anatomical changes within the abdomen.

To this latter group belong chiefly adhesions resulting from various inflammatory processes (such as cholecystitis, appendicitis, mesenteritis, pericolitis, inflammations of the adnexa) or from operative procedures (appendectomy, gastroenterostomy, liver operations, etc.).

The adhesions resulting from pericolitis are localized chiefly to the cecum and ascending colon and only occasionally to the proximal portion of the transverse colon.

Six cases of pericolitis with adhesions are described in more or less detail.—*T. Leucutia.*

Talia, F. Su alcuni casi di dolicocolon con sintomatologia clinica rara. (Some cases of dolichocolon with unusual symptomatology.) *Arch. di radiol.*, July–Aug., 1929, *7*, 676–691.

Six cases are described and illustrated by roentgenograms and similar cases from the literature reviewed. Most of the cases seen are partial dolichocolon; total dolichocolon is very rare; in the author's Case VI there was elongation of the whole colon, though that of the sigmoid was most marked. Partial dolichocolon of the ascending and descending colon is also rare; the author's Case II was an example of the former; in addition to unusual length and abnormal arrangement of the ascending colon there was colitis and pericolitis and unusual clinical symptoms. In Case III signs of occlusion were caused by the elongation and abnormal position of the descending colon. The other three were cases of elongation of the ilio-pelvic part of the colon, which is the most usual form. The first patient was a boy of fourteen who had had intestinal disturbance since early childhood; at the age of four he had prolapse of the rectum when he was constipated. This change in the sphincter of the rectum and the last part of the colon was probably due to the elongation of the latter. In the case of elongation of the ascending colon there were repeatedly signs of acute occlusion which threatened the life of the patient. In Case III the symptoms were worse at the menstrual period; the symptoms began at the age of puberty and increased in severity. The patient was then well for awhile but suddenly had signs of occlusion which from the roentgen picture might have been interpreted as due to pericolitis or chronic invagination. In Case IV there was fever with signs of colitis and at one time melena. In Case V there was enlargement of the bulb of the duodenum from periduodenitis and in Case VI a dolichosigmoid which simulated inflammation of the adnexa and was treated at first by diathermy with considerable improvement, but the symptoms recurred some years later.

Ulcer of the duodenum is one of the most serious complications of these cases. There are other cases that simulate tumor from accumulation of feces and others with high fever in which the diagnosis cannot be made from clinical examination; diagnosis of the nature and site of the disease can only be made by roentgen examination.—*A. G. Morgan.*

Lignières. A propos d'un cas de sténose hypertrophique du pylore chez un nourrisson. Étude radiologique. (Hypertrophic stenosis of the pylorus in an infant; roentgenologic study.) *Bull. et mém. Soc. de radiol. méd. de France*, June, 1929, *17*, 212–215.

A case of hypertrophic stenosis of the pylorus observed in a baby two months old is described in detail and the roentgenograms are presented. The case is interesting because of a slow and progressive evolution of the pyloric stenosis simulating an organic stenosis such as is seen in adults.—*T. Leucutia.*

Dall'Acqua, V. Ulcera preantrale in soggetto con mesenterium commune. (Pre-antral ulcer in a patient with common mesentery.) *Arch. di radiol.*, May–June, 1929, *7*, 501–514.

The patient was a man of twenty-three who had always been well until he was twenty-one, when he began to have rather intense pain an hour or two after meals in the epigastric region, which was relieved by food or by lying on his left side. He was treated from December, 1927, to February, 1928, for stomach ulcer. One

evening in September, 1928, he suddenly had excruciating epigastric pain and loss of consciousness. He was sent to a hospital where an emergency operation was performed with a diagnosis of acute peritonitis from perforation. Operation showed a perforated ulcer in the pre-antral region. It was excised and the opening sutured. Recovery was uneventful but it was not long until the patient began to vomit and have such intense colic that it could not be controlled by morphine. Operation showed loose adhesions uniting some of the loops of small intestine to each other and to parts of the large intestine and fixing various parts of the intestine to the anterior wall of the abdomen. The operations were freed without difficulty and it was found in the course of the operation that all the small intestine was to the right of the midline, including the duodenum which continued directly into the jejunum without a trace of Treitz' ligament. The large intestine was entirely on the left. The patient recovered and has had no symptoms since.

Roentgen examinations were made when the patient was sent to the hospital in December, 1927, and again in January, 1929, before the second operation. On the first examination the stomach was vertical with its caudal pole three fingers breadths below the line connecting the crests of the ilium; a niche showed the site of the pre-antral ulcer. The examination showed the abnormal position of the intestines, and the pylorus was eccentric. In the second examination this eccentricity of the pylorus persisted. It was probably due to spastic contracture of the musculature of the antrum. This sign may be useful as indicating contracture. It was impossible in this case to demonstrate the adhesions which caused such serious trouble.

Common mesentery has been held responsible for a dyspeptic symptom-complex but there were no signs of functional stomach disturbance in this patient before the acute signs of ulcer began. The author thinks such symptoms are not caused by the malformation itself but by the morphological constitution of the subject and they may or may not be found in common mesentery.—*A. G. Morgan.*

Vallebona, A. L'applicazione sperimentale del metodo combinato allo studio della cavita peritoneale. (Experimental use of the combined method in the study of the peritoneal cavity.) *Arch. di radiol.*, July–Aug., 1929, *7*, 758–766.

The author describes the technique of his method of insufflating air into the peritoneal cavity in rabbits and then injecting iodized oil. Roentgenograms are given showing the very clear pictures obtained. But though this is an excellent experimental method it has certain dangers in practical use. The dangers of introducing iodized oil into the peritoneal cavity are added to those of pneumoperitoneum. In order to cover the whole peritoneum with a thin layer of iodized oil it is necessary to introduce quite a large amount of it and this may cause intoxication. This is the greatest danger in the practical use of this method in man. Another danger is that the oil may irritate the peritoneum and cause inflammation. And even the production of a reaction that causes adhesions would be a contraindication to the use of the method in man. So at present no attempt should be made to use the method clinically.—*A. G. Morgan.*

GYNECOLOGY AND OBSTETRICS

Beck, Alfred C. A case illustrating the value of the x-ray as an aid in the management of polyhydramnios. *Am. J. Obst. & Gynec.*, Aug., 1929, *18*, 257–258.

Beck reports a case of polyhydramnios in which the roentgen examination in the thirty-first week of pregnancy showed a fetus having a relatively small head. Immediate interruption of pregnancy resulted in the delivery of a hemicephalic monster. About 8 liters of amniotic fluid were drained away after rupture of the membranes. By the aid of the roentgen ray a definite decision to empty the uterus was reached. While the same conclusion would have been formed at a later date without the aid of the roentgen ray, the patient was spared considerable suffering because of the early diagnosis. Early interference, before the appearance of maternal indications for interruption of pregnancy, greatly lessened the risk.—*R. S. Bromer.*

GENITOURINARY SYSTEM

Hirst, John C. The kidney of pregnancy. *Am. J. Obst. & Gynec.*, Oct., 1929, *18*, 528–545.

Hirst states that the purpose of his paper is to summarize and coordinate the present

knowledge of the kidney of pregnancy, and to present certain additional information. The title is used in a broad sense to include the following study:

1. The diagnosis of hydronephrosis, infected hydronephrosis, and pyelitis complicating pregnancy, with a comparison of the relative frequency of appendicitis and gall-bladder disease.

2. The relation of hydronephrosis and pyelitis to early and to late gestational toxemia.

3. Differential kidney function tests and pyelograms to discover additional factors in the cause of the common hydronephrosis of pregnancy, with special attention to the possibility of ureteral edema or chronic passive congestion that might be a contributing cause to late gestational toxemia and eclampsia.

4. An attempt to differentiate renal and hepatic toxemia of pregnancy by the effect of heparmone administration.

His study contains a review of over 70 leading articles, not only on the above subjects but also on the newer aspects of renal and hepatic function, and the classification of gestational toxemias. The second part contains tables and illustrations from his experience from May 1, 1926 to May 1, 1929, with the behavior of the kidney of pregnancy. For ten years he has had charge of the cystoscopic work in the Department of Obstetrics of the Hospital of the University of Pennsylvania and this report is based upon cases from this clinic. Numerous illustrations of pyelograms in cases showing infected hydronephrosis, deviation of the ureter with low grade infection of moderate hydronephrosis and hydroureter, bilateral nephroptosis before and after pregnancy, and calculus and constriction of the ureter, are clearly reproduced. The tables are very complete.

Hirst thinks that certain conclusions appear sound:

1. Cystoscopic urologic diagnosis is an important part of an obstetric service, and when carefully performed carries no undue risk.

2. Vasodilatation and circulatory stasis of the distal ureter may directly or indirectly be concerned with late gestational toxemia.

3. Early and late toxemia are essentially different; the latter is primarily renal in origin.

4. Heparmone appears to bear insufficient specific action to separate a hepatic type from the late forms of pregnancy toxemias.

Certain significant facts, Hirst states, were brought out by a summary of the 97 obstetric patients subjected to urologic diagnosis by cystoscopy and pyelography. These are of interest to roentgenologists interested in pyelography.

1. Ureteral obstruction appeared only four times, in the form of calculus twice, and congenital narrowing of the orifice and stricture. This absence of frequent obstruction presupposes some additional factor responsible for impaired drainage not accounted for by atonic ureteral dilatation or latent infection so common in pregnancy. This impairment he believes is circulatory in the form of intermittent vasodilatation or chronic passive congestion of and around the distal ureter, evidenced by edema of the orifice in the form of irregularity of shape and puffing.

2. Jaundice did not appear in any case, but one instance of subacute exacerbation of a chronic cholecystitis followed ureteral catherization. Therefore it appears that even if the renohepatic interrelation be of importance in infection and toxemia, it plays no great part in careful cystoscopy of the obstetric patient.

3. Other harmful results of urologic investigation included two troublesome increases in severity of chronic pyelitis, and one precipitation of labor at term.—*R. S. Bromer.*

Bronner, H., and Schüller, J. Der Blasen-Nierenrückfluss (vesiko-renaler Reflux). Klinische und röntgenologische Beiträge. (Vesico-renal backflow [vesico-renal reflux]. Clinical and roentgenological contributions.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, September, 1929, *40*, 419–436.

The vesico-ureteral or vesico-renal reflux is variously described in the literature as vesico-renal backflow, insufficiency of the vesico-ureteral ostia, forced ureters, gaping of the ureters, etc. The lesion never occurs under normal conditions because of the valve-like action of the ureteral orifice. As soon as there is disturbance of the physiologic function of the bladder and ureters, the valve-like action of the ureteral orifice ceases and a vesico-ureteral or a vesico-renal reflux ensues.

Conditions leading to disturbances in the action of the ureteral orifice are: (1) marked hypertonia of the bladder musculature due to tenesmus in different diseases; (2) disturbances due to narcosis or lumbar anesthesia; (3)

ureteral rigidity in certain inflammatory conditions, leading to the so-called "golf hole" or "funnel-shaped" orifice, etc.

One case, that of a girl twenty-four years of age, suffering with diffuse tuberculous cystitis and cavernous tuberculosis of the left kidney, in which a vesico-renal reflux developed on the opposite side, is described in detail. The first stage of the vesico-renal reflux of the opposite (right) side was observed previous to the operation, and it was thought that the nephrectomy on the left side would lead to a disappearance of the condition. Check-up cystograms made fourteen days, one month, one and a half months, and again fifteen months later, however, showed gradual progression of the vesico-renal reflux to a complete hydronephrosis.

Since the above case was observed during the entire course of the disease, the author was able to study the various stages of vesico-renal reflux. Thus first there is only a slight dilatation of the lower portion of the ureter with the urine entering into this part of the ureter. Later the urine enters as high as the kidney pelvis and there is progressive dilatation of the entire ureter. In the third stage tortuosity, with occasional kinking of the ureter develops, leading to retention of the urine in the upper portion of the ureter and kidney pelvis. The final stage of the disease is marked by hydronephrosis.

The symptomatology of the patient is in accordance with the various stages of the disease. Thus first there is only a drawing sensation in the lower back, then the sudden desire to urinate develops. This is especially marked when changing from the horizontal into the vertical position, and often results in urinary incontinency. In the final stage micturition in two or several periods follows. This latter is due to the fact that during the actual micturition the bladder expels the urine both into the urethra and towards the kidney. At the end of the systole of the bladder the urine which has entered the dilated ureter and kidney flows back into the bladder and the patient has to urinate again. In more advanced cases this phenomenon may repeat itself three to four times until a complete emptying of the bladder is obtained.

Cystography is the sovereign method of examination in vesico-renal reflux. Especially in the later stages of the disease, it often leads to spontaneous filling of the ureter and kidney pelvis. The direct application of pyelography is contraindicated since the slightest pressure may lead to the opaque substance entering the venous system of the kidney, the so-called pyelovenous reflux. The best opaque media are a 12 per cent solution of sodium iodide, a one to four solution of umbrenal, or a 5 per cent solution of iodipin.

The various diseases leading to vesico-renal reflux are: (1) tuberculosis of the bladder and kidney. This, according to Bumpus, is responsible for 40 per cent of all refluxes and occurs in 20 per cent of all cases with tuberculosis of the kidney. The reflux may extend, as in the case already mentioned, also to the normal kidney. This of course constitutes a very serious complication. Occasionally it may spontaneously disappear following removal of the diseased kidney or conservative treatment of the bladder. (2) Infections of the bladder or of the kidney pelvis. This type of reflux is relatively benign and as a rule it disappears as a result of conservative treatment. (3) Conditions associated with retention of long standing as, for example, ureteral stricture, hypertrophy of the prostate, etc. It is interesting in this respect that according to the observation of Bumpus the vesico-renal reflux which accompanies enlarged prostates increases from 4.74 per cent to 11.42 per cent following prostatectomy. This must be explained by the frequent occurrence of infections following the operation of hypertrophic prostates which, as indicated in (2), is a frequent cause of vesico-renal reflux. (4) Implantation of the ureters into the colon as practised in certain operations. Maydl's attempt to transplant the entire trigone of the bladder into the colon so as to prevent the reflux has led to no better results. Often 70 to 80 per cent of all colonic transplantations of the ureters result in renal reflux, necessitating the later removal of the kidney. (5) Transvesical resection of enlargements of the lower portion of the ureter (ureterocele). (6) Certain instances of ureteral stones, producing partial obstruction, and finally (7) certain spinal cord lesions and in very exceptional cases congenitally.

The question as to whether vesico-renal reflux always leads to insufficiency of the affected kidney is not as yet definitely settled.—*T. Leucutia.*

Sargent, James C. Interpretation of the seminal vesiculogram. *Radiology*, June, 1929, *12*, 472–483.

A series of vesiculograms, visualizing a few over 200 seminal vesicles, have been reviewed by the author and compared with the clinical findings. This includes normal cases as well as cases of acute and chronic gonorrheal vesiculitis, chronic non-gonorrheal vesiculitis, and tuberculous vesiculitis. He concludes that the vesiculogram is constant and does not vary from a characteristic normal in normal men, nor does it vary from time to time in the same individual so long as the condition of the vesicle remains the same. Dilatation of the seminal vesicle, in part or in whole, occurs commonly in cases of chronic vesiculitis of several months' duration. This dilatation is thought to be atonic in nature and is not permanent if the inflammation subsides. Dilatation of the ampulla of the vas or of the ejaculatory duct occurs, the result of organic stricture, and, when present to any degree, remains permanently. Diminution in the cavity of the vesicle is a constant finding in acute gonorrheal epididymo-vesiculitis, and is thought to be due to inflammatory swelling of the vesical wall. This change is temporary and disappears with recovery from the disease. Contraction of the wall of the vesicle, with extreme decrease in the cavity, even to the point of obliteration, occurs as the result of long-standing inflammation. This change in the vesiculogram is seen in chronic vesiculitis, either of gonorrheal or tuberculous origin. The vesiculogram reveals abscess of the seminal vesicle, when present, and communication with its cavity. Obstructions of the seminal tract, as well as anomalies of the vas and seminal vesicle, are revealed in the vesiculogram.—*J. D. Camp.*

McCrea, Lawrain. A contrasting medium for pyelographic study. *J. Am. M. Ass.*, Sept. 28, 1929, *93*, 987–988.

Attention is called to the necessity of having a pyelographic medium that can be detected as it regurgitates from the ureter when used in conjunction with indigo carmine. Sodium iodide, now the most universally used pyelographic medium, cannot be observed when the regurgitated fluid from the ureter is colored by the indigo carmine. The following medium has been prepared and is now being successfully employed:

Sodium iodide	12 gm.
Emulsion of silver iodide 5 per cent	20 gm.
Distilled water sufficient to make	60 gm.

This combination is a thin, watery, creamy-white mixture and can be readily detected by the observer watching the ureteral orifice as a bluish cream-colored fluid. The contrasting medium is of advantage in cases in which there is an obstruction of the ureter.—*Karl Kornblum.*

Steinharter, E. C., and Brown, Samuel. Uterocystography. *Am. J. Obst. & Gynec.*, August, 1929, *18*, 259–260.

The authors combine uterography and cystography, claiming that the combination has advantage over either method used alone. Their report is a preliminary one, submitted in the hope that others will make use of the combined method and publish their results.

They include illustrations of cases in which the combined method was used which show the possibility of diagnosing adhesions between the uterus, fallopian tubes and urinary bladder, or an encroachment of any other adventitious structure upon the urinary bladder. This method permits the visualization of the field beyond the reach of simple uterography, i.e., in the uterovesical space as well as in the areas lateral to the bladder.—*R. S. Bromer.*

SKELETAL SYSTEM

Pigorini, L. Sopra tre casi di articolazione coraco-clavicolare osservati radiologicamente. (Roentgen study of three cases of caracoclavicular joint.) *Arch. di radiol.*, July–Aug., 1929, *7*, 784–793.

The author describes 3 cases of a joint between the clavicle and the coracoid process of the scapula which he studied roentgenologically. He does not think that there is sufficient evidence that it is due to residues of structures that have disappeared in the course of the development of the race, but thinks it is caused by partial ossification of the ligaments which normally connect the clavicle and the coracoid process. It may be favored by special individual peculiarities, for example changed relations between the clavicle and coracoid process.

The condition is quite rare so it is hard to

draw any conclusions in regard to its clinical importance. It is frequently found associated with tuberculosis of the apex, but as it occurs in the region which is chiefly subjected to examination for pulmonary tuberculosis this may be mere coincidence. It is true, however, that this joint may decrease the function of the apex and so tend to encourage the development of tuberculosis. Another hypothesis is that it may facilitate fracture of the surgical neck of the humerus in cases of contrecoup. Such a joint does reduce the movement of the shoulder girdle so that the head of the humerus finds an almost rigid wall in the glenoid cavity incapable of softening a blow which is transmitted wholly to the humerus and so makes fracture more probable. Giongo denies this however and says that he had a patient who fell from a ladder and suffered a severe contrecoup of the shoulder; there was subcoracoid luxation of the head of the humerus but no fracture of the humerus. Possati says he saw osteophytes on the joint surfaces and on the ligaments of the shoulder girdle in such a case due to the rigidity of the shoulder girdle and the fact that the movements of some kinds of hard work produce osteophytes when the possibility of movement of the two bones is limited. This anomaly may also cause mistakes in interpreting the percussion findings in the clavicular region, particularly when the anomaly is unilateral and the percussion findings are compared with those on the other side.—*A. G. Morgan.*

Panner, H. J. A peculiar affection of the capitulum humeri, resembling Calvé-Perthes' disease of the hip. *Acta radiol.*, 1929, *10*, 234–242.

Three cases of this joint affection are described and illustrated with roentgenograms. In all of the cases the lesion followed a definite trauma in boys ten years old or less. The symptoms are mild, consisting only of minor functional disturbances. There is always complete restoration to normal but the disease lasts three years or more. The roentgen picture is typical. Only the condyle of the humerus is affected. At first there is only slight rarefaction, resembling fissures, with some blurring of the structure. Later the center of ossification is decreased in size, its outline indistinct and its nucleus fragmented. The picture as a whole is very much like that of the center of ossification of the head of the femur in Calvé-Perthes' disease. Finally the center of ossification gradually resumes its normal shape and appearance. There is no doubt that the affection belongs to the same group as Calvé-Perthes' disease—disorders of the center of ossification—the etiology of which is unknown.—*A. G. Morgan.*

Balestra, G. Sulla coxa plana. (Coxa plana.) *Arch. di radiol.*, July–Aug., 1929, *7*, 767–783.

This disease generally affects children less than ten years of age and is variously called juvenile osteochondritis deformans of the hip, coxa plana, metaepiphysitis of the upper end of the femur, coxalgia and Perthes' disease. Four cases are described. The roentgenograms show that after this disease there is apt to be deformity of the upper end of the femur characterized chiefly by flattening of the head of the femur and more or less marked deviation of the neck. The changed static and dynamic conditions and perhaps other factors that cannot be evaluated exactly, make these joints a good soil for the development of arthritis deformans both in the youth and adult. Taking this fact into account the prognosis of Perthes' disease becomes much more serious than it has usually been considered.—*A. G. Morgan.*

Coppa, E. Su di una rara anomalia congenita isolata dello scheletro dell'avambraccio. (An unusual isolated congenital anomaly of the radius.) *Arch. di radiol.*, May–June, 1929, *7*, 553–557.

A case is described in a girl of fourteen; she had never noticed anything wrong until her gymnastics teacher told her to go to a physician for examination of her right elbow. The physician said she was suffering from the results of infantile paralysis and sent her to the hospital for electrical treatment. The teacher had noticed that when the children made movements of pronation and supination of the hands with the arms extended the child's right arm did not make the movement of supination. Examination showed the muscles of the arms equally well developed and there was no history of infantile paralysis. Roentgen examination showed fusion of the epiphyses of the radius and ulna at the expense of that of the radius. The lesion is called radio-ulnar synostosis in the literature. In this case there was ossification of

the interosseous ligament extending down to the boundary between the upper and middle thirds. This is very rare. There were no other abnormalities in the child's skeleton.

The first case of this kind was discovered on the autopsy table in 1830; the first case diagnosed by roentgen examination was reported by Joachimsthal in 1900. It appears to be due to interference with transverse development of the tissues at an early period of embryonic life. It is important practically sometimes in industrial accidents when the congenital limitation of function is attributed to an injury. The differentiation can be made by roentgen examination; in traumatic synostosis the joint is enlarged, while in congenital synostosis it is either normal or decreased in size; the outlines of the joint are changed in traumatic synostosis and the interarticular line is not normal, while they are perfectly normal in the congenital case. And the arrangement of the trabeculae shows the congenital nature of the fusion, as the trabeculae of the epiphysis follow the laws of normal development. The lesion does not interfere greatly with work, as supination is not a position that is assumed frequently in most kinds of work.—*A. G. Morgan.*

Schnek, Fritz. Divergierende Luxation im Bereich der distalen Handwurzelknochenreihe. (Divergent luxation in the region of the distal carpal bones.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, September, 1929, *40*, 484–485.

A case of trauma to the hand occurring in a young worker is described because of the peculiar injury. In addition to the fracture of the fifth metacarpal there was disturbance of the carpometacarpal joint with displacement of the distal ends of the hamatum and capitatum and with fragments broken loose from the multangulum and scaphoid.

Because of the slight external deformity produced, the condition was first treated as a bruise and the more serious nature of the injury was only discovered two months later following a roentgenographic examination.—*T. Leucutia.*

Simon, Siegfried. Zur Diagnose der frühkindlichen Extremitätentuberkulose im Röntgenbild. (The roentgenologic diagnosis of tuberculosis of the extremities in early childhood.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, September, 1929, *40*, 448–456.

Fourteen cases of tuberculosis of the bones of extremities are briefly described and their roentgenograms presented in order to prove that the typical roentgenologic signs of tuberculosis cannot be always encountered in early childhood. A confusion with lues and osteomyelitis is often possible. Thus the diseased areas may appear sharply circumscribed and associated with periostitis such as is observed in lues. The atrophy may be only local and very slight.

In other instances it may be entirely impossible to differentiate between tuberculosis of the shaft and staphylococcus osteomyelitis.—*T. Leucutia.*

Buchman, Joseph. A résumé of the osteochondritides. *Surg., Gynec. & Obst.*, October, 1929, *49*, 447–453.

The author defines osteochondritis as "a non-inflammatory derangement of the normal process of bony growth occurring at the various ossification centers at the time of their greatest developmental activity." Muller in 1888 was the first to call attention to the condition when he described epiphyseal coxa vara or displacement of the capital epiphysis of the femur. Since that time similar conditions have been found to occur at practically every ossification center that is subject to stress and strain. Several of these have received the name of the writers first describing them, such as Osgood-Schlatter's disease of the tibial tubercle, Calvé-Legg-Perthes' disease of the capital epiphysis of the femur, Freiberg's infraction of the second metatarsal, Köhler's disease of the tarsal scaphoid, Scheuermann's disease or vertebral epiphysitis and Calvé's disease or osteochondritis of the vertebral body.

It is generally agreed that these conditions are manifestations of a common systemic affection. The particular age period of each lesion is dependent upon the period of most active development of the epiphysis involved. The pathological entity is modified by the location of the disease. Cases have been reported in which there has been a multiplicity of lesions.

While the etiology of osteochondritis has not yet been definitely established, the author believes that tuberculosis, syphilis, rickets, the theory of endocrine dyscrasia, the infectious

theory and the theory of aseptic embolism, necrosis and minute compression fractures can be discarded. The experimental work of Mau, Schmorl and Harrenstein would seem to indicate that trauma, in the form of increased stress and strain, is an important etiologic factor. Mau has shown that rapidly growing bone cells are physiologically weak. An increased stress or strain or a decreased capacity to withstand stress or strain occurring at the time of rapid growth from static imbalance will result in derangements of the normal process of growth, giving rise to compression fractures and irregularities in growth.

The pathology of osteochondritis is not very well established. The pathological changes that have been described consist of a destruction of the epiphyseal cartilage and an invasion of the already ossified areas by islands of cartilage. As the condition progresses, hemorrhage and necrosis, indications of trauma become evident.

Clinically all of the osteochondritides are similar in their symptomatology. The onset is gradual and may or may not be associated with trauma which is, when present, usually slight. There may be no other manifestations than the developing deformity. All the symptoms are mild, the patient, as a rule, being in general good health. The condition may be bilateral, though only one side may give rise to symptoms. As has been noted, the age of onset is parallel with the age of the most active growth of the affected area, thus the centrum of the body of the vertebrae is affected during the first few years of life, the superior and inferior vertebral epiphyses between the ages of ten and twenty-one. Legg's disease commonly occurs between three and ten, Osgood-Schlatter's disease between thirteen to fifteen, Köhler's disease of the tarsal scaphoid from three to fifteen, apophysitis of the os calcis nine to thirteen, and Köhler's disease of the metatarsophalangeal joint between ten and eighteen years of age.

Likewise the roentgenologic appearance of the various forms of osteochondritis is very similar. There is a widening of the epiphyseal line with areas of rarefaction and condensation. The outlines are indistinct, the entire picture having a hazy, mottled appearance. Later, the bony areas become moth-eaten and their outlines irregular. With reparation there is condensation and reformation of the lamellar structures. The gross deformities remain after healing has taken place.

Because of the meager knowledge concerning the condition, treatment must of necessity be symptomatic. All of these derangements are self limited and are terminated on completion of ossification. The greatest hope in treatment is the prevention of deformity. Existing deformity should be corrected immediately. Early recognition of the condition and the immediate institution of rest to diminish stress and strain on the affected parts will alleviate pain and prevent deformity. Treatment should be continued until ossification is complete.—*Karl Kornblum.*

Wissing, Egon. Sarkom bei Osteodystrophia fibrosa. (Sarcoma in osteodystrophia fibrosa.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, September, 1929, *40*, 457–462.

Two cases of osteodystrophia fibrosa (Paget's disease) are described which later developed into sarcoma.

The first case is that of a man fifty-three years of age with a Paget manifestation on the right and left humerus, scapula, right clavicle, right femur, left scapula, left clavicle, left femur, pelvis and a few vertebrae, and with sarcoma of the right clavicle which was probably the primary focus, and metastases to all osteodystrophic areas, liver, spleen, abdominal organs, etc.

The second case is that of a man sixty-nine years of age where the Paget manifestations occurred in the right femur, right tibia and fibula, right humerus, left femur, left tibia and fibula, left foot, pelvis, skull and spine, while the sarcomatous degeneration appeared on the left ankle and skull.

The cases are published in support of the view that osteodystrophia fibrosa represents a presarcomatous state and that malignant degeneration is a frequent complication of the disease.—*T. Leucutia.*

Geschickter, Charles F., and Copeland, Murray M. Osteitis fibrosa and giant cell tumor. *Arch. Surg.*, Aug., 1929, *19*, 169–271.

This is a comprehensive study of giant cell tumor, osteitis fibrosa and bone cyst with a foreword by Joseph Colt Bloodgood. This investigation is based on an analysis of over 400 cases from the Surgical Pathological Laboratory of the Johns Hopkins Hospital.

By a study of the embryonic histology of bone and the normal repair of bone following injury the authors have shown that giant cell tumors, osteitis fibrosa and bone cysts are different phases of a definite pathological variation in the reparative process of bone. Thus these lesions are definitely associated with trauma; they occur at ages during which normal bone formation is most active, and in locations most subject to trauma, namely the upper and lower ends of the femur, the upper end of the tibia and humerus and the lower end of the radius. This pathologic variation is the result of an imbalance in two normal repair processes—osteoclastic giant cell proliferation and the formation of new bone directly from fibroblasts. This latter process the authors term fibro-ostosis.

When the osteoclastic giant cell proliferation is in the ascendency a giant cell tumor results. Since osteoclastic proliferation is normally most active in the epiphysis, giant cell tumor is most commonly located in this portion of the bone. Healing occurs by the process of fibro-ostosis. Should healing not be complete the lesion known as fibro-osteitis results. A further stage in the healing process is characterized by cyst formation surrounded by fibroid tissue in which there are giant cells, fewer in number but similar to those found in giant cell tumors and fibro-osteitis. This is the bone cyst. The periosteum and the compact cortical bone, especially that of the metaphysis, have great reparative ability; thus the healing phase of giant cell tumor, the bone cyst, is most commonly found in the metaphysis.

There are numerous transitions in this pathologic variation of bone repair and these transitions give rise to a number of lesions which are simply variants of the three major lesions. Thus we have the giant cell variants of the bone cyst in the metaphyseal ends of the long bones, polycystic osteitis fibrosa, the spindle cell variant of the giant cell tumor. It is also shown that multiple giant cell tumors, multiple bone cysts, and multiple osteitis fibrosa are frequently associated with other diseases such as rickets, congenital syphilis, osteogenesis imperfecta and fragilitas ossium.

With the establishment of this conception of the nature of giant cell tumor an attempt is made to bring the giant cell tumors, other than those occurring in the long bones, in agreement with this theory. According to this theory giant cell tumor only arises in bone derived from cartilage. Giant cell tumors of the skull apparently would not fit into this scheme since most of the bones of the cranium and face are derived from membrane. A study of the available giant cell tumors of the skull showed that all of them arose from those portions of the bones of the skull derived from cartilage. Thus these tumors were brought into agreement with the theory.

Likewise epulis of the alveolar border which apparently is a tumor of the soft tissues and not of bone, was found to support the theory when through a study of these lesions it was found that they are intimately associated with the activity of the odontoclasts in the shedding of the deciduous teeth.

From the chaotic group of tumors classed as xanthomas there was segregated a restricted group always found associated with tendons and in which giant cell tumor tissue is characteristic. A study of these tumors showed that they had their origin from sesamoid bones which in turn are derived from fibrocartilage. Thus these xanthic tumors lend support to the theory.

The subperiosteal giant cell tumor, a lesion of modern recognition, serves best to illustrate the theory advanced by the authors. These lesions are definitely associated with trauma. They show the characteristic histology of both giant cell tumor and osteitis fibrosa and show that these changes are related to a disturbance in the normal blood supply of bone which on the one hand acts as a stimulus to the proliferation of osteoclasts thus predisposed to giant cell tumor formation and on the other hand stimulates the healing potentialities of the periosteum with the production of osteitis fibrosa.

In conclusion, the importance and necessity of studying neoplastic diseases from the standpoint of the embryonic histology and normal histogenesis of the tissues affected is pointed out and emphasized.—*Karl Kornblum.*

GENERAL

McCord, J. R. A study of two hundred autopsies made on syphilitic fetuses. *Am. J. Obst. & Gynec.*, Oct., 1929, *18*, 597–601.

McCord considers the study of syphilis and pregnancy in the colored race in the South

an economic as well as a scientific obligation. In a former study published several years ago he found that, of the stillbirths and early prenatal deaths, 45 per cent had syphilis and 12 per cent probably had syphilis. The incidence of syphilis in his present study is 41 per cent, with a probable incidence of an additional 8 per cent. The smaller percentage in the later study is perhaps due to the fact that more early abortions were studied. The organism of syphilis was found in 61 babies. Every baby was examined roentgenologically for evidence of syphilis in the long bones. The bones were positive in 83 babies, or 41 per cent.

A positive diagnosis of syphilis was made upon the findings of one or both of the following: the demonstration of the organism of syphilis in the stained tissues, and the characteristic lesions of the long bones as revealed by the roentgen ray.

A probable diagnosis of syphilis was made when the maternal blood Wassermann reaction was strongly positive and the histologic changes in the mature placenta were plainly positive.

Syphilis in the premature, the histologic changes of syphilis in the new-born, maternal Wassermann reactions, cord Wassermann reactions, methods of staining of the syphilitic organism, histology of the placenta, some of the causes of death, and the changes in the long bones are discussed under separate headings. The changes in the long bones are of most interest to the roentgenologist. Positive changes were found in 83 of the 200 cases examined, or 41 per cent. The bones were positive and the organism of syphilis was not found in 17 babies. McCord believes he can explain this discrepancy only by the belief that in certain cases the spirochetes do not take the silver stain. The bones were negative twice where the organisms were present. The bones were positive in 7 cases where no silver staining was done. The bones were positive and the placentas premature positive in 10 cases. The bones in the babies were positive and the maternal Wassermann tests were negative 21 times.

The following conclusions, McCord regards as axiomatic: (1) Syphilis is only transmitted to the baby by way of the placenta. (2) The lesions of the long bones as demonstrated by the roentgen ray are pathognomonic of fetal syphilis. (3) The organisms of syphilis fail to stain in a certain number of cases—probably in as many as 12 to 15 per cent. (4) A mature placenta with the histology of syphilis is rarely found without other positive evidences. (5) Even moderate antisyphilitic treatment during pregnancy will save a majority of babies. (6) Mild arsenical and mercurial treatments have no injurious effects upon pregnant women. —*R. S. Bromer.*

Laurell, Hugo. Über Röntgenuntersuchung bei Typhus Abdominalis und bei einigen seiner abdominellen Komplikationen.(Roentgen examination in typhoid and some of its complications.) *Acta radiol.*, 1929, *10*, 243–353.

A case of typhoid in a girl aged nineteen is described. Roentgen examination showed moderate enlargement of the spleen with diffuse meteorism, both in the small and large intestines, without a fluid level. Such an extensive meteorism in an adult could only have been caused by a paralytic or mechanical ileus, severe infection, pseudoileus, such as is caused by eating raw fruits or vegetables, certain forms of insufficiency of the heart or swallowing air. In connection with the fever and the clinical course typhoid fever was the most probable diagnosis.

The author concludes that roentgen examination is not of great value in the diagnosis of uncomplicated typhoid but is of great value in the early diagnosis of its dangerous complications.—*A. G. Morgan.*

ROENTGEN AND RADIUM THERAPY

Borak, J. Röntgentherapie bei Knochengeschwülsten. (Roentgen therapy of bone tumors.) *Strahlentherapie*, 1929, *33*, 435.

In treating bone tumors by roentgen rays the technique of irradiation is of primary importance. A dose of 600 R or 12 H, divided into several sittings, is administered over the site of the lesion. The amount of radiation given in one sitting, the so-called maximal daily dose, represents 450,000 roentgen volume units. (The roentgen volume dose is obtained by multiplying the surface of the port of entry with the depth and the full dose. If, for example, the surface is 15×15 cm., the depth 20 cm. and the

full dose 100 per cent S. U. D., the roentgen volume dose will be $15 \times 15 \times 20 \times 100 = 450{,}000$ units.) As a rule treatment is repeated only once within six weeks. Further repetition remains of no avail.

1. Bone Granulation Tumors. The author proposes the term "bone granulation tumor" or "bone granuloma" (osteogranuloma) in place of osteitis fibrosa cystica local sata which is more commonly used and which recently has replaced the term of giant cell sarcoma. Bone granuloma expresses the true nature of the condition more vividly than osteitis fibrosa cystica localisata, since it embodies reactive growth of cellular structures on the basis of a traumatic intraosseous tissue injury. The tumor in its first stage is, as a rule, solid, and fibrocystic or sclerotic degenerations do not occur til later. In differentatiing the stages of degeneration the following terms are proposed: osteogranuloma fibrosum, cysticum, fibrocysticum, ossificans.

The author is of the opinion that the term of "giant cell tumor" as applied in America does not convey accurately enough the nature of the tumor since giant cells form only part of the structure encountered in this condition. Furthermore, the term "bone granulation tumor" implies a certain radiation response of the lesion, which is not the case with the term of "giant cell tumor."

Twelve cases were treated by the author during the past seven or eight years (3 after curettage, one after partial operation, one following recurrence and 7 primarily), all having been healed. A complete functional and morphological restitution was obtained.

In the majority of cases of bone granuloma diagnosis can be made on the basis of the roentgenologic appearance. In a few instances, especially if a differentiation from malignancy is necessary, a biopsy is indicated.

The opinion is expressed that radiation therapy is the method of choice. Bone granulomas are in this respect similar to tuberculous lymphomas. They are excellently influenced by radiation, show practically no recurrence following the completion of the radiation treatment and in very rare instances may regress spontaneously. If an operation is performed, this should consist, especially in long bones, of curettage and not of amputation or dissection as formerly practised.

2. Bone Sarcomas. Ninety per cent of all patients with true bone sarcoma die within three years. Radiation therapy is indicated in the following instances: (*a*) in the cases with distant (especially lung) metastases. The author has seen extensive lung metastases entirely disappear following roentgen therapy, in one case over a period of two and a half years; (*b*) in cases localized to parts of the skeleton which are surgically inaccessible such as pelvis, spinal column, base of the skull, etc.; (*c*) in all round cell sarcomas. Experience shows that cellular homogeneous sarcomas are more radiosensitive than fibro-, chondro- or osteosarcomas. If the microscopic examination of a biopsy shows round cell sarcoma irradiation should be applied. Of course, in the majority of instances it is difficult to decide whether a sarcoma is of the round cell type since there is a certain danger connected with every biopsy of bone tumors, but there is one tumor which can be readily diagnosed on the roentgen appearance alone as a round cell sarcoma and this is Ewing's tumor. Several instances of such tumors are cited in which radiation therapy led to satisfactory response.

In all other types of bone sarcoma surgery is the method of choice and irradiation should be carried out only if surgical intervention is refused.

3. Carcinoma Metastasis to Bone. This may be (*a*) solitary, (*b*) multiple and (*c*) generalized.

During the past five years the author has treated about 60 cases of carcinoma metastases to the bone with good temporary results, in rare instances the improvement lasting as long as five to six years. However, not one single cure was observed in the entire series.—*T. Leucutia.*

Hubert, Louis, and Robinson, G. Allen. Radium therapy in atrophic rhinitis with offensive odor (ozena). *Arch. Otolaryngol.*, August, 1929, *10*, 166–170.

The authors report 5 cases of atrophic rhinitis with offensive odor (ozena) treated by radium. Radium was thought of as a therapeutic agent because the disease is apparently self limited, disappearing after middle life. They felt that it was probable that the fibrosis of the nasal mucosa in old age had something to do with the disappearance. With this as a clue, radium was used as an agent to produce

fibrosis. The technique was as follows: Twenty mg. of radium element screened in tubes equivalent to 0.2 mm. platinum and 1 mm. brass was placed on each lateral wall of the nose for 90 minutes. Subsequently two 50 mg. tubes were placed on each side of the nose for one hour. Their results indicate some improvement in the condition but not a cure.—*E. P. Pendergrass.*

Milani, G. Roentgen treatment of Vaquez's disease. *J. Am. M. Ass.*, Oct. 19, 1929, *93*, 1205–1208.

Vaquez's disease of polycythemia is characterized by abnormally high red blood cell count. The cause is not definitely known. Many experiments were performed to determine whether a substance was present in the blood of these individuals which stimulated formation of red blood cells, but without conclusive result. The only significant positive pathological finding is found in bone marrow.

At autopsy the long bones are entirely filled with red marrow almost to the complete exclusion of yellow fat marrow. This has been a constant finding, but the cause is not known.

The author has found roentgen treatment when applied over the enlarged spleen of no value, but when applied in a systematic manner over the long bones to give lasting relief and symptomatic if not actual cure.

From the cases referred to in the literature and from the author's experience in these 2 cases, he feels justified in concluding that roentgen therapy represents the most efficacious and most certain means for the cure of Vaquez's disease, and when it is well applied and regulated, and accurately supervised, gives brilliant and lasting results, arresting the fatal evolution of the disease.

Only time and experience will tell how long the state of well being of these patients will last. Some months ago his first patient stated that the number of red corpuscles was about 5,000,000 and that she was in good health. Three years has passed since the last irradiation.

As to the organs that must be irradiated, it is apparent that irradiations of the spleen have not given favorable results, though repeatedly tried.

Irradiation of the flat bones will sometimes result in a slight improvement, which, however, is transient.

In the first patient, after roentgen therapy of the sternum and of the vertebral column, a slight improvement was noticed, both in number of red corpuscles, and in the general condition; but after a short time the red corpuscles increased again and the condition of the patient became the same as before. In the second patient, roentgen therapy of the flat bones did not result in any improvement.

When, on the other hand, the irradiations were applied to the long bones, the number of red corpuscles decreased to normal; the spleen returned to physiologic limits, the high red coloring of the face diminished and the hemorrhages disappeared as did all the other subjective secondary symptoms.

The happy outcome of this therapy brings a clinical contribution of great value to the pathogenesis of this disease, because it shows clearly that the element responsible in the hematologic and clinical picture of the disease is the marrow of the long bones, on which the unknown etiological factor acts almost exclusively, and it indicates the method to be followed in the treatment of polycythemia.—*L. R. Sante.*

Fried, Carl. Die Röntgentherapie des Erysipels. (The roentgen therapy of erysipelas.) *Strahlentherapie*, 1929, *33*, 673–681.

Fifty-four cases of erysipelas (42 true erysipelas and 12 erysipeloids) were treated by the author, and the results obtained have been so satisfactory that roentgen therapy is considered as the method of choice. In many instances, especially in the acute cases, there was a drop of temperature within twelve to twenty-four hours following irradiation and there was a rapid clearing up of the process. The final tabulation of the cases revealed that in 80.5 per cent there was healing (in 22 of the 42 erysipelas cases the temperature having dropped within twenty-four to forty-eight hours and in 12 within three to four days following one single irradiation). Only 4 cases died, 2 from erysipelas, one from complicating pneumonia and another from an accidental disease.

The technique of irradiation is 120 to 200 r per field, in case that one single port of entry is used and 120 r per field, in case that several portals are used; 100 to 160 kv. eff., 4 to 8 ma. 0.5 mm. Zn or 0.5 mm. Cu and 1 mm. Al as filters, the focus skin target distance depending

on the extent of the lesion and thus on the size of the field. If the lesion is very extensive it is advisable to treat only the marginal parts. At least twenty-four hours should elapse between two irradiations and the treatment may be repeated two to three times.—*T. Leucutia.*

Karlin, M. I. Zur Röntgentherapie der Pende-Beule (Orientbeule, Hautleishmaniose). (Roentgen therapy of Pende boils (Oriental boils, skin leishmaniosis).) *Strahlentherapie*, 1929, *33*, 682–690.

Oriental boils occur endemically in certain portions of Asia and Africa, especially in Syria, Morocco, Tunis, Egypt, Turkmenistan and Usbekistan. It is also called the Aleppo boil (from the city Aleppo in Syria) or Biskra boil (from the name of a place in Algiers), and finally Pende boil (from the small village Pende in South Usbekistan). The condition is due to a protozoa which was first described by Leishman, hence the name leishmaniosis.

Three cases (women) of Oriental boils were treated by the author with roentgen rays, in the first case the boils having been on the face, in the second on the face and upper extremities and in the third on both upper extremities. The first had one single series, the second two series and the third three series of irradiations. The duration of the disease previous to the treatment was from eight to eighteen months. The technique of irradiation was 150 kv., 3 mm. Al, 30 to 50 per cent skin unit dose on the skin, 2 to 4 irradiations at 14 to 20 days' intervals. A good healing was obtained in all three instances.—*T. Leucutia.*

Siedentopf, Heinz. Klinische Erfahrungen mit der Röntgenschwachbestrahlung bei gynäkologischen Entzündungen. (Clinical experiences with mild roentgen irradiation in gynecologic inflammations.) *Strahlentherapie*, 1929, *33*, 637–651.

Seventy cases of gynecologic inflammations (9 inflammations of the adnexa, 16 parametritis, 40 inflammations of the adnexa complicated with parametritis, and 5 other types of inflammations) were treated at the Leipzig clinic with mild irradiation. The technique was as follows: Stabilivolt apparatus, Coolidge tube, 173 kv., 5 ma., 0.4 mm. Cu, large fields, 20 per cent skin unit dose if the sagittal diameter of the patient in the abdominal region exceeded 15 cm., and 15 per cent skin unit dose if it was less than 15 cm.

The subjective improvement consisted in the relief of pain, while the objective improvement was controlled chiefly by the fall in temperature and by the palpatory findings. Of the 40 cases of inflammation of the adnexa complicated with parametritis, in 10 cases the condition was the result of pus-forming bacteria; in 12 cases the etiology was unknown and in 18 cases of gonorrheic origin. In 26 cases there was subjective improvement; in 8 cases no improvement and in 6 cases there was aggravation of the symptoms, while the objective improvement was demonstrated in 20 cases; in 15 cases there was no improvement and in 4 cases there was aggravation of the disease.

Of the 16 cases of parametritis, in 11 the infection followed septic abortion, while in 5 cases the etiology was unknown. A subjective improvement was obtained in 7 cases, while in 6 cases there was no improvement and in one case there was aggravation of the disease. An objective improvement was present in 8 cases; in 5 there was no effect and in one there was aggravation of the physical findings. Of the 9 cases of true inflammation of the adnexa, chiefly of septic and gonorrheic origin, the subjective improvement was demonstrated in 4 cases, in one case there was no improvement and in 3 cases there was aggravation, while the objective improvement was present in 2 cases, no improvement in 2 cases and in 4 cases there was aggravation of the disease. The additional 5 cases irradiated were inflammations which did not originate from gynecologic organs (sweat gland abscess, surgical infections, etc.). The response of these infections to mild irradiation was rather favorable.

The conclusion is reached that in true parametritis the results are favorable, while in inflammations of the adnexa only the chronic cases are amenable to irradiation. In the acute and subacute stages very often an aggravation of the disease is observed following irradiation. In inflammation of the adnexa complicated with parametritis the attention has to be directed towards the inflammation of the adnexa which is the more important of the two. Septic inflammations respond more favorably to irradiation than gonococcic inflammations. As a whole, roentgen therapy in gynecologic inflammations should be used with great caution and only in very well selected cases.—*T. Lueucita.*

Holthusen, H. Der gegenwaertige Stand der Strahlenbehandlung beim Karzinomen. (Present status of radiotherapy in carcinoma.) *Deutsche med. Wchnschr.*, Sept. 6, 1929, *55*, 1491–1495.

The first exaggerated enthusiasm in regard to roentgen rays was followed by an equally exaggerated pessimism and this is now giving place to a more rational understanding of the advantages and defects of the method. The old rule that all operable tumors should be operated on now no longer holds good. The effect of the rays is dependent to a considerable degree on the nature of the tumor. There are carcinomas that should be irradiated even if they are operable and various combinations of radiotherapy and surgery are possible. Primary irradiation is especially indicated in carcinoma of the face. It gives equally as good clinical results and much better cosmetic results. Excellent results have been obtained with a combination of roentgen and radium treatment. Radiation therapy is to be preferred to surgery only for the primary tumor; the gland metastases should be operated on. Operation is also being given up more and more in favor of radiotherapy in carcinoma of the cervix. In epithelial cancers of the cervix the results of radiotherapy are at least as good as those of surgery, and perhaps better in view of the fact that there is practically no operative mortality. Adenocarcinomas are resistant to rays but fortunately they make up only a small percentage of carcinomas of the cervix. Operation gives better results that radiotherapy in adenocarcinomas of the body of the uterus. Radiotherapy is not so much indicated in carcinoma of the breast, not so much because its results are not good as because these cases often come for treatment in an early stage when surgical treatment is effective. The best use of rays in cancer of the breast is for the postoperative irradiation of the field of operation and the regional glands. Combined surgical treatment and radiotherapy is indicated in cancer of the rectum. Radium seems to be better than roentgen treatment for tumors of the larynx and thyroid. Radiotherapy is not very effective in carcinomas of the digestive tract, including those of the esophagus.

The enthusiasm aroused by the early use of roentgen rays has been transferred to radium and some now think it a miracle-worker. But as a matter of fact unless large amounts are available for distant irradiation its use is limited to readily accessible tumors to which it can be applied locally. But the excellent results sometimes obtained with it justify all the efforts being made to improve the technique of its application.—*A. S. Morgan.*

Hernaman-Johnson, F. The present position of x-ray therapy in malignant disease. *Brit. M. J.*, Oct. 5, 1929, *2*, 618–620.

In 1914 at the annual meeting of the British Medical Association, the Section of Radiology arranged a debate on the relative value of roentgen rays and radium in malignant disease. The chief points claimed in favor of roentgen rays were availability, unlimited quantity, and most important of all, evenness of distribution in the tissues, owing to the fact that it was possible to use a roentgen tube at a considerable distance from the patient. On the other hand, the advantages of radium were set forth as follows: It could be brought into intimate relation with malignant growths, either by its introduction into cavities such as the esophagus, or by actually burying radium tubes, or by inserting multiple needles. It was also claimed that, apart from questions of quantity, distribution, etc., radium rays, by which were meant chiefly gamma rays, were qualitatively of more value than roentgen rays. There was said to be a further advantage in the standardization of dosage, or rather of output which in the case of radium depended only on the quantity of radium and filter used; while the roentgen tube of the period was difficult to control. The proponents of the roentgen rays admitted the claim of difficulty of control to some extent but felt that, with technical advances, the output of roentgen tubes excited at high voltage would more nearly approach the gamma ray in quality, and that exact control of output would also be secured.

Radium, in a sense the most dynamic of all elements, must however in a therapeutic sense be regarded as static. In other words, the radium in use today is the same agent precisely as that in use twenty years ago, though its mode of application may differ. This is not the case with roentgen rays. The introduction of the hot cathode tube by Coolidge made the control of output easy, and later developments produced roentgen tubes capable of standing

up to a quarter of million volts for continuous running. Working with voltages of this order, the directors of the gynecological clinic at Erlangen claimed a high percentage of "cures" —three to five years—in cases of carcinomata of the cervix uteri such as previously had been dealt with by pan-hysterectomy. The technique as originally introduced required the administration of a so-called "lethal dose" at a single sitting. With the outputs then available this meant seven or eight hours' continued exposure. Severe anemia and violent sickness were often produced and many patients died from the effects of the treatment. Unfortunately an idea became prevalent in England that the new roentgen rays were of almost equal value in all forms of cancer, which probably increased the intensity of the effects of this form of treatment. By the time the medical and the lay public in England became interested in this technique, it was already going out of favor in the country of its origin, and as it faded into the background the technique was correspondingly modified and the part played by the local and the general reaction of the patient was taken into account.

The years 1913 and 1914 may be described as "boom" years for radium; 1922 and 1923 were boom years for the new roentgen therapy. After 1923 the latter began to decline in favor, and in 1928 radium was once more in the ascendant. The problem today, however, is much like that of 1914. Radium is scarce in England; roentgen rays are almost everywhere available. At present the burying of radium is greatly in favor. The chief advances in radium technique over that in use fifteen years ago consist in the use of more numerous foci of irradiation—radon seeds or radium needles —and a wider encirclement of the growth to be attacked.

Realizing the limitations both of surgical implantation and of surface applications, the Paris Radium Institute has been using relatively large quantities of radium at a distance of 10 cm. from the skin. This is an approach to the technique of deep therapy. Regaud warns radium enthusiasts that no final verdict can yet be given as between the natural gamma rays of radium and the artificial gamma rays generated in a roentgen-ray bulb.

Hard facts must be faced in England in regard to the cancer problem. All roentgen departments in hospitals with large out-patient clinics are crowded with cancer cases. To change from roentgen rays to radium there would be needed in England alone, more than the whole world's present supply of radium. It is quite obvious that roentgen rays must be used for many decades to come, and advocates of radium who decry their use do a disservice, not only to the roentgen workers but also to the public. In a considerable proportion of cases of advanced carcinoma of the uterus it is possible to dry up all bleeding and discharge, and abolish pain with the use of roentgen rays. The patient returns to ordinary duties for six, eight or even twelve months, and then usually succumbs very quickly to an acute recurrence.

The author regards preliminary use of roentgen rays followed by palliative surgery as the method of choice in extensive inoperable carcinomas of the breast. He believes both medium and hard rays are necessary in the treatment of breast carcinoma. He regards postoperative irradiation also as of great importance. He has no hesitation in claiming that in some cases a combination of roentgen rays and ultraviolet therapy will add months or even years to a patient's life. The effect of the light is a constitutional one, analogous to what occurs in patients suffering from lupus and other tuberculous lesions. Cancerous growths are only arrested for varying periods; they are not made to disappear by the use of light, but mental depression often disappears and a feeling of restored well-being returns, even perhaps the gain of a few pounds in weight results.

In conclusion, he states that the aim of the out-patient clinics of many hospitals in England has been to keep the cancer patient on her feet with the use of roentgen rays or combined surgical methods, free from pain, cheerful in mind, and physically unobjectionable, until a final rapid internal spread of the disease removes her after a few weeks of bed-ridden life. This aim has been accomplished in a majority of cases, and can be accomplished more readily now than was the case even two or three years ago.—*R. S. Bromer.*

Steinhardt, Bianca. Was leistet die Röntgenbestrahlung der Hypophyse bei Behandlung klimakterischer Beschwerden? (Roentgen irradiation of the hypophysis in the treat-

ment of climacteric disturbances.) *Klin. Wchnschr.*, Sept. 10, 1929, *8*, 1717–1718.

Sahler who has extended the use of roentgen irradiation in this field reports 102 cases in 63 per cent of which cure or very great improvement was brought about. Reëxamination of another 150 cases treated from 1924 to 1927 showed good results in 79 per cent. A third of the cases were permanently cured; that is, they were free of symptoms more than a year after the termination of the treatment and the rest were greatly improved. There was complete failure only in 10.6 per cent and 10 per cent were only temporarily helped. The effects are particularly good in climacteric disturbances after roentgen castration. Permanent cure was attained in 19 of 27 cases, or 70 per cent. But there were only 25 per cent permanent cures in operative castration.

Both temporal fields were irradiated at a single treatment, each with one-third of a skin erythema dose. Generally even in the most favorable cases this first treatment brought about improvement for only four to eight weeks; after a second series the effects generally lasted for four to five months and it required three to four series to bring about permanent cure. Some cases had to be given five series. So the treatment should not be stopped too soon. Among the author's 16 failures 7 cases were treated only once and it is possible that at least some of these would have been successes if further treatment had been given. The author thinks that as a matter of precaution a second series should be given six to eight weeks after the first, even if the effects of the first one still persist, and a third should be given after three to four months. He has never seen any unpleasant by-effects even on repeated treatments. While the treatment has an excellent effect on the vasomotor symptoms of the climacteric, the joint pains sometimes seen in the climacteric are rarely cured even by roentgen treatment. In some cases in which irradiation of the hypophysis failed, a combined treatment with irradiation of the thyroid has been successful. Irradiation of the hypophysis has been successful in cases in which other methods have failed but there are relatively few cases in which irradiation has failed and other treatments, including hormone treatment, have been successful. The author thinks irradiation of the hypophysis is the treatment of choice in climacteric disturbances.—*A. G. Morgan.*

Pordes, Fritz. Die Röntgenbestrahlung der Schilddrüse bei Erkrankungen dieses Organs und bei anderen Störungen. (Roentgen iradiation of the thyroid gland in primary lesions of this organ and in other disturbances.) *Strahlentherapie*, 1929, *33*, 652–666.

The thyroid gland may have a subnormal, normal and hypernormal function. The reaction of the thyroid gland to irradiation may be summarized as follows: (1) An increased functional activity of the thyroid gland cannot be obtained by irradiation under any circumstances. (2) The normal thyroid gland shows little radiosensitivity and is not affected by the usual therapeutic doses. (3) A pathologic increase in the function of the thyroid gland renders the organ more radiosensitive, with the result that even the slightest hyperfunction can be well influenced by irradiation.

In exposing the thyroid gland to therapeutic roentgen rays the reaction produced is of great importance. While previously the opinion prevailed that this reaction, which, as a rule, follows shortly after irradiation, is the result of an increased function of the thyroid gland due to the stimulation by roentgen rays, now it is generally admitted that the reaction is the result of increased permeability (incontinency) of the cells, leading to thyrotoxic symptoms. The early reaction is important for two reasons: (1) it indicates that small doses of roentgen rays have to be used, and (2) it permits certain diagnostic conclusions, especially in the cases in which diagnosis of a hyperfunction of the thyroid gland cannot be made with certainty. The provocation of a reaction following the administration of roentgen rays in such instances indicates that the condition is of a thyroid origin. This test, however, ought to be used with great discretion since thyroid patients are very easily influenced and since the criteria of the reaction consist chiefly in signs which are more or less under subjective control (increased psychic restlessness, loss of sleep, increased diarrhea, elevation of temperature, etc.). It is advisable, therefore, to first determine how much of these symptoms is due to the irritation connected with the treatment. For this reason the author administers on the first day a make-

believe treatment, that is, everything is arranged as though a regular treatment were given with the exception that a lead filter is inserted in the tube opening. The next day the patient is questioned as to the effect and then a regucalr treatment is given. Only a positive test can be used for diagnostic purposes, while a negative test is without significance.

1. Roentgen treatment of Basedow's disease. The roentgen treatment of this condition leads in 80 per cent of the cases to very satisfactory results so that irradiation constitutes the method of choice. Operation is indicated only (1) in large goiters with pressure symptoms and (2) in cases where roentgen therapy has failed. If, during the first two months there is no improvement surgical intervention may be considered; a case, however, should not be declared definitely recalcitrant, until at least six months have elapsed.

The procedure of irradiation is as follows: First a blind treatment (with the insertion of a lead filter) is given, then the next day a true irradiation is applied. Two anterior fields are used and 100 R is administered on the surface of each field with 0.3 mm. Zn and 2 mm. Al as filters, 170 kv. max., 35 cm. distance. A rest of two or several days is given between the two irradiations. The series is repeated within eight to ten days and then within fourteen days to three weeks (depending on the symptomatology) for a period of three months, that is, until a total dose of 500 R per field is given. In case of very large goiters three fields are used; one middle and two lateral fields. Treatment is completed when a suitable symptom-free status is obtained. This does not necessarily mean restitutio ad integrum. The exophthalmos and the struma may persist even following the completion of the treatment and a basal metabolic rate between 25 and 30 per cent is not rare. The pulse also may stay around 100. In such instances the patient is to be kept under observation and check-up examinations should be made every three months. In case of a return of the symptoms the treatment is continued. One has to keep in mind, however, that too much radiation may lead to hypothyroidism. It is a well-observed fact that recurrences following completion of roentgen treatment are less frequent than following operation.

2. Roentgen therapy of disturbances without the true picture of morbus Basedowi. Such disturbances are characterized as oligosymptomatic hyperthyreoses and they may be divided into two main groups: (*a*) the *forme fruste* of Basedow, and (*b*) conditions which are not of thyreogenic origin but which are provoked in the presence of hyperthyreosis.

(*a*) The *formes frustes* of Basedow or the oligo- or monosymptomatic hyperthyreoses present a very manifold symptomatology. If one or several symptoms are predominating in the presence of a mildly developed Basedow, the condition may be classified as Stern's Basedowoid, Charcot's *formes frustes*, Kraus's thyroid heart, etc. If there is only a mild hyperfunction of the thyroid gland the symptoms may be so few that an entirely different condition is diagnosed. This refers especially to the so-called thyreogenic pseudotuberculosis which is often diagnosed as an incipient tuberculosis and which is nothing else than a mild hyperthyreosis. Subfebrile state, increased perspiration, fatigue, loss of weight, tremor, unstable pulse (within ten minutes from 130 to 90) predisposition to diarrhea, etc., are the chief symptoms of this condition which is observed mostly in young girls of erethismic type. The administration of a few small doses of roentgen rays over the thyroid gland often produces truly remarkable results, indicating that we are dealing with a form of hyperthyreosis.

Irradiation of the thyroid gland may be of considerable aid also in climacteric disturbances. Therefore, if the irradiation of the pituitary gland does not lead to the expected results, an irradiation of the thyroid with very mild doses should always be attempted. Both the monosymptomatic and the oligosymptomatic hyperthyreosis may be encountered here.

Mild irradiation of the thyroid gland may prove of benefit also in certain obscure clinical conditions with a tendency to diarrhea, loss of weight, psychic irritability, restlessness, etc.

(*b*) Conditions in which the coincidence of hyperthyreosis produces aggravation of the disease or which are directly provoked by the presence of hyperthyroidism are gastric ulcers, glaucoma in women near the climacterium, hyperidrosis manum of neurotic type, eczema chronicum flexurarum, etc. The irradiation of the thyroid gland with mild doses may lead here to a complete healing of the process.

In the final part of the article the etiology of morbus Basedowi is discussed and the opinion is expressed that there is an intimate relation between the hyperactivity of the thyroid gland and the vegetative system. Operation and roentgen therapy produce only a reduction of the function of the thyroid gland, whereas the final purpose ought to be a complete reestablishment of the balance between the incretion on the one side and the nervous regulation on the other side. When we are able to accomplish this the question of treatment of hyperthyroidism will be definitely solved.—*T. Leucutia.*

Hirsch, Henri. Weitere Erfahrungen mit der Röntgen-Dextrocidbehandlung bösartiger Tumoren und ihr weiterer Ausbau. (Further experiences with the roentgen-dextrocid treatment of malignant tumors and its further use.) *Strahlentherapie*, 1929, *33*, 696–703.

Ten to 20 c.c. dextrocid is injected by the author intravenously previous to each roentgen irradiation, so that in certain cases a total dose of 100 to 150 c.c. is injected during the course of a series. The dextrocid is a 50 per cent dextrose solution of iodine cerium with the addition of cacodylic acid. Its effect consists in the sensitization of the tissues for subsequent roentgen irradiations.

Two hundred cases were treated altogether.

The technique of the irradiation remains the same, that is, one skin unit dose is administered within three to four days, as a rule, 1/3 S.U.D being administered at a time, and immediately following the dextrocid injection. In case of irradiation of the abdominal organs only 1/10 of a skin unit dose is administered at one sitting. Although permanent results are not always obtained by the combination of the roentgen-dextrocid irradiation in the treatment of malignant tumors, the immediate results are so remarkable that its use is indicated.

More recently the author has been experimenting with the use of hypocid treatment in case of very cachectic individuals in which the dextrocid injection was poorly tolerated.—*T. Leucutia.*

Fuhs, Herbert. Über die therapeutischen Erfolge der Radiumstrahlen bei Induratio penis plastica. (On the therapeutic influence of radium rays in induratio penis plastica.) *Strahlentherapie*, 1929, *33*, 667–672.

In 1924 Riehl and Kumer reported 41 cases of induratio penis plastica which were treated at the Vienna Radium Station. Ten of these cases were completely healed, 11 improved, 17 did not complete the treatment and in only 3 cases was there no result.

Since then many other cases have been treated by application of radium so that now the total number of cases treated reaches 80. The results of these cases are analyzed by the author in detail.

The technique of irradiation was practically the same as that of Kumer and already given in his article, with the exception that lately Dominici tubes have been used exclusively and filtered by 1 mm. brass. The initial dose was 40 to 30 mg-el-hr., the treatment having been repeated at two to four weeks' intervals with subsequent doses of 20 to 15 mg-hr. In the majority of the cases a total of ten to fifteen treatments were given; in rare instances the number of irradiations being as high as seventeen to twenty-five. Skin changes were observed only in the cases which received very intensive irradiation.

Of the total cases treated, 19 (25 per cent) were cured; 19 (25 per cent) improved; 15 uninfluenced and 27 did not complete the treatment. Of the uninfluenced cases 6 have received as many as fourteen to forty-five irradiations without effect and 9 are still under treatment, having received only from two to nine irradiations. If the patients who did not complete the treatment are discounted, the percentage of cure and improvement increases to 43 per cent each, only 14 per cent remaining uninfluenced.

A number of cases of induratio penis plastica were roentgenographed previous to the treatment to determine if the presence of calcifications or bone new formations has any prognostic value as regards the outcome of the treatment. It was found that of 29 cases examined in only 5 cases was there evidence of calcifications and in only one case evidence of bone new formation. It was further found that all these cases showed rather poor response to the radium treatment. It seems, therefore, that the procedure of Kumer which consists in a preliminary operation followed by radium therapy is of greater advantage and consequently the method to be followed in such instances.—*T. Leucutia.*

Wehefritz, Emil. Über Myombehandlung. (On the treatment of myoma.) *Strahlentherapie*, 1929, *33*, 467–470.

The question whether uterine myomas should be operated upon or submitted to roentgen or radium irradiation is discussed in detail.

The advantages of operation consist in the rapid removal of the tumor, leading to immediate relief of symptoms, and in the possibility of conservative procedure (enucleation of the myoma) in case of smaller tumors. The disadvantages of the operation are the rather high operative mortality, which is still between 1.7 and 3.0 per cent, and the operative injury to neighboring tissues.

The advantages of roentgen therapy consist in the entire lack of shock or mortality and in a slow regression of the tumor in at least 85 per cent of the cases. The disadvantages are that in 3 per cent there is absolutely no response and that in case of incomplete exovulation the bleedings continue.

The gamma rays of radium or mesothorium, though used considerably less than the roentgen rays, lead to excellent results in cases with severe bleeding because of the caustic effect on the mucous membrane of the uterus.

The following indications are established: Operation is indicated when the diagnosis of myoma is not certain; when there is a question of differential diagnosis between myoma and ovarian tumor or a myoma and tumor of the adnexa; in young individuals; in case of degenerated or submucous fibroids and in suspicion of malignancy.

Irradiation is indicated in case of complicating systemic disease such as heart lesions, chronic nephritis, tuberculosis of the lung, advanced arteriosclerosis, etc., and in cases of severe anemia. In this latter radium is often more advantageous.

In very large fibromas reaching above the umbilicus, the question of which method to use is not yet decided. While irradiation is not contraindicated surgical intervention produces a more rapid relief of the pressure symptoms.

The series of myomas observed at the Göttingen Frauenklinik between 1919 and 1925 includes 225 cases of which only 68 were treated by irradiation and 157 by operation. Often the method to be chosen is a question of individual preference.—*T. Leucutia.*

Fürst, Walter. Untersuchungen über die Dosierung harter Röntgenstrahlung aus Fernfelden bei der Behandlung des Collumcarcinoms. I. (Investigations on the dosage of hard roentgen rays with distant fields in the treatment of collum carcinoma. I.) *Strahlentherapie*, 1929, *33*, 601–636.

From 1914 to 1920 all collum carcinomas at the Frankfurt Universitäts-Frauenklinik were treated under the direction of Walthard exclusively by the application of radium. The institution had 300 mg. of a 96 per cent radium bromide at its disposal and the cases treated received an average of 10,000 mg-hr. radium radiation. The four-year results were published in 1920 by Eckelt, the percentage of absolute healing reaching 16 per cent, and the primary mortality due to application of radium being 3.7 per cent.

In 1920 Walthard after being transferred to the Zürich Universitäts-Frauenklinik and because of the rather poor results obtained with radium at Frankfurt, returned to a pure operative procedure.

It remained, therefore, for the author to carry out investigations with regard to the value of roentgen therapy in collum carcinomas. By making use of very hard roentgen rays he first tried to cover the surface of the body with paraffin layers so as to obtain a more homogeneous distribution of the radiation on the surface of the skin since as is known the first few centimeters near the surface of the body absorb a larger quantity of radiation. The interposition of paraffin layers would make the skin a deep seated area with the result that a larger dose of radiation could be given. The paraffin layers were, as a rule, 3 cm. thick. Very soon it was found that there was no advantage in using such a procedure. Moreover, the exact determination of the tolerance dose of the skin proved very difficult.

In a second series of patients the author applied the roentgen rays directly on the carcinoma through the vagina so as not to have any interposing layers between the carcinoma and the roentgen rays. The purpose was to create conditions identical to those existing for the treatment of skin carcinomas. The vagina was held open with a special speculum which the author constructed of wood and the radiation was carried from 100 cm. distance. This method beside the fact that it is very

complicated and associated with certain danger also failed to produce satisfactory results.

Finally, the author introduced the irradiation through two simultaneous ports (one anterior and one posterior) with very great distances and high filtration. Numerous measurements revealed that such a procedure leads to a greater homogeneity of the radiation and the time of treatment is reduced to half. The clinical results are very satisfactory and it is therefore the method of choice at the institution.—*T. Leucutia.*

Asherson, N. Inoperable carcinoma of cervix treated by radium transperitoneally. *Brit. M. J.*, Sept. 21, 1929, *2*, 538-539.

Asherson reports three cases of carcinoma of the cervix treated by radium, intravaginally and transperitoneally. These cases each received radium transperitoneally, 2 cases having 5 tubes each of 10 mg. of radium sulphate, screened by 0.3 mm. of platinum embedded in the tissue surrounding the cervix, the other having four tubes embedded in the same manner. These patients also received radium treatment intravaginally.

Case I was alive and clinically free from the disease four years after treatment was begun; Case II died three years after, and Case III, fifteen months after treatment. The disease in Case I was more advanced than in the other two.—*R. S. Bromer.*

v. Spindler, H. Schädigungen durch Röntgen- und Radiumstrahlen? (Injuries from roentgen and radium rays.) *Deutsche med. Wchnschr.*, Aug. 23, 1929, *55*, 1417–1418.

It is true that injury was often done by rays in the early period of their use before adequate measures for protection were known. But the author thinks there is now a tendency to ascribe injuries to the action of rays without sufficient evidence. He cites as an example the case of a forty-three year old woman who had been irradiated during the third and fourth months of pregnancy. The child was born with an intense general edema and died in five minutes. This was attributed to the irradiation but congenital universal hydrops is known without irradiation and there was no special evidence that it was caused by the rays in this case. Another case is described of a woman who had menstrual disturbance, loss of appetite and weight and feeling of weakness and such symptoms have been seen in several cases of sisters who spent several hours a day in a room where radium preparations were kept; the symptoms were attributed to the action of the radium. But the author says that the amount of irradiation was too small to cause symptoms and that they might very well have been caused in other ways. He insists that in cases described as roentgen or radium injury, evidence of direct injury cited and the amounts of irradiation be given.—*A. G. Morgan.*

MISCELLANEOUS

Bouwers, A. Der Brennfleck einer Röntgenröhre und die Belastbarkeit. (The focal spot of the roentgen tube and its load-carrying capacity.) *Fortschr. a.d. Geb. d. Röntgenstrahlen*, August, 1929, *40*, 284-292.

1. The temperature of the anode and its load-carrying capacity. The load-carrying capacity of a diagnostic roentgen tube depends on the construction of the anode and on the size of the focal spot. Experience has taught us that a focus of a certain size carries only a certain load (expressed in watt), and that it is irrelevant whether, for example, 120 ma. and 40 kv. or 60 ma. and 80 kv. are used, assuming, of course, that the time of exposure remains the same. The author found that if the anode is made of copper and provided with a thin Wolfram disc it may carry a load the maximum value per square millimeter of which is 200 watt per second. A larger load would result in an increase of temperature of the anode and in a vaporization of the Wolfram (the vaporization corresponding at 3000°C. to 1 mg. per minute for 1 sq. cm. curface and a complete melting occurring at 3372°C.). The limit of increase of temperature for the copper is about 1050°C., and at 1080°C. the copper melts.

The increase of temperature of the anode during flash exposures was calculated theoretically and plotted graphically. It was found that for very short exposures up to 0.04 sec. the temperature at the anode increases according to the following formula:

$$T = CW\sqrt{t}$$

where T equals temperature, t time of exposure and W watts per square millimeter, C representing a constant which depends on the heat conductivity and heat capacity of the anode.

For longer exposures up to one second the raise of temperature is slower.

2. The type of focal spot. Investigations with regard to the best type of focus lead to the conclusion that the line focus is preferable to the round focus. The angle of the roentgen rays to the surface of the anode should amount to about 20°. The line focus carries a load which is from 1.5 to 2.0 times larger than that carried by a round focus.

3. The size of the focal spot. The size of the focus is far less important than the type of focus and its load-carrying capacity. A larger focus requires of course a greater load in order to give the same sharpness of the roentgen image. It was found, for example, that a 6 kw. tube gives the same sharpness as a 5 kw. tube if the distance of the 6 kw. tube is 10 per cent greater than that of the 5 kw. tube (example, 100 cm. for 5 kw. tube and 110 cm. for 6 kw. tube). The general belief that a tube with a smaller focal spot yields sharper images than a tube with a broader focal spot holds true only in the case that a change of the focus film distance is impossible. The dimensions of the focal spots must show a variation greater than 100 per cent in order to lead to perceivable distortions in the roentgen image.

The dependence of the time of exposure on the size of the focal spot is graphically plotted. It was found, for example, that a 2 kw. tube is about 10 per cent less efficient than a 4 kw. tube and that a 1 kw. tube is entirely unsuitable. Also the unlimited increase in size of the focal spot is not advisable and is certainly uneconomical. A tube having a focal spot of 4 times 12 sq. mm. (which would correspond to a 10 kw. tube) would represent the upper limit in the way of increase of focal dimensions.

The conclusion is reached that an improvement in the quality of roentgenograms, and a shortening of the time of exposure are not obtained by the increase in the size of the focal spot. Only a rotating anode, the construction of which is now under experiment, can serve such a purpose.—*T. Leucutia.*

Solomon, Iser. L'unité dosimétrique de rayonnement de roentgen. Exposé et interprétation des résolutions adoptées par le Congrès international de radiologie de Stockholm (juillet 1928). (Dosimetric unit of roentgen radiation; presentation and interpretation of the resolutions adopted at the International Congress of Radiology in Stockholm, July, 1928.) *Bull. et mém. Soc. de radiol. méd. de France*, January, 1929, *17*, 45-49.

After presenting the resolutions of the Second International Congress of Radiology on the adoption of the electrostatic unit, the author calls attention to the fact that certain problems pertaining to the measurement of the unit are not sufficiently clarified. One of these is that no definite apparatus for the measuring of the electrostatic unit was adopted. The recommendation that the measurement be done with large ionization chambers does not suffice since, as shown by Failla, discrepancies as high as 300 per cent may occur with large ionization chambers of different types.

The second problem is that the standardization of the instrument with the radium preparation is not made under well-defined conditions. As is known the precision of a radium standardization depends (1) on the utilization of an ionization chamber independent of wave length, and (2) on the utilization of small ionization chambers of the order of 1 $cm.^3$ and of very small sources of radioactive substances approaching the point source.

(1) The independence of the ionization chamber on the wave length is now fairly well solved and this applies also for the Solomon chamber.

(2). The utilization of small ionization chambers of the order of 1 $cm.^3$ was emphasized by Glasser and Seitz, and Behnken and Jaeger. The author is actually studying the reduction of the ionization chamber of his ionometer to the size of 1 cc. The fabrication of very small radium sources approaching the size of a point is likewise under study. Thus, all that remains is the determination of the distance of the radium source from the ionization chamber. This was measured by Glasser and Seitz as being 1.4 cm. and the same value was obtained by the author.

By taking into consideration the above factors, a standardization of the Solomon ionometer into the electrostatic unit is possible.—*T. Leucutia.*

Zacherl, H. Über die Bedeutung des reticuloendothelialen Apparates bei der Röntgenbestrahlung des Collumcarcinoms. (On

the significance of the reticulo-endothelial system in roentgen irradiation of collum carcinoma.) *Strahlentherapie*, 1929, *33*, 515–536.

The not infrequently observed fact that collum carcinomas show rather active growth following intensive roentgen irradiation, especially when a full carcinoma dose is administered in one sitting, while smaller doses seem to inhibit the growth of the tumor, induced the author to investigate the effect of the roentgen rays on the general resistance mechanism of the organism.

It is well known that at least a part of the general resistance of the body depends on the phagocytic capacity of the reticulo-endothelial system. The changes in the rate and amount of phagocytosis due to roentgen irradiations were studied by the author experimentally.

1. In a first series of experiments saccharated ferrous oxide was injected intravenously into rabbits and the changes in the function of the reticulo-endothelial system were studied by determining the iron content of the serum according to the method of Lundwall and Zechner. The detailed procedure was as follows: The normal function of the reticulo-endothelial system was first analyzed by determining the iron content of the serum of the blood of rabbits four and sixty minutes following intravenous injection of the saccharated ferrous oxide (10 c.c. of a 5 per cent solution). For this purpose, 4 c.c. of blood were taken in a paraffinated tube from the ear vein of the rabbit immediately previous to, four minutes and one hour after the injection, and centrifuged so as to obtain a serum entirely free of hemoglobin. One cubic centimeter of the serum was then used for the microchemical determination of the iron according to Lundwall and Zechner. Four weeks later the animals were irradiated; some of them with rather mild doses (60 per cent skin unit dose) and others with very heavy doses (so that the animals died within eight to ten days). It was found that while in the normal rabbits the absolute amount of iron four minutes following the injection was 52.4 per 1000 mg. and 38.3 per 1000 mg. one hour following the injection, in the cases which received the mild irradiation the values (the injection of saccharated ferrous oxide having been made six hours following the irradiation) were 12.6 per 1000 mg. and 9.5 per 1000 mg. respectively, and in the cases with very intensive irradiation (the injection again having been made six hours following the irradiation) 44.4 per 1000 mg. and 11.4 per 1000 mg. respectively. This indicates that the function of the reticulo-endothelial system is greatly influenced by the irradiation, there being an increase of the phagocytic function as a whole. This increase is more pronounced in the mild irradiations.

2. In a second series of experiments the phagocytic capacity of the reticulo-endothelial system for bacteria was determined in guinea pigs. One cubic centimeter of colon bacilli (in 1 c.c. nutrient bouillon) was injected intraperitoneally; thirty minutes and three hours following the injection the peritoneal exudate was aspirated with a glass capillary tube and stained with May-Grünwald solution. Four hundred cells were counted and the corresponding number of phagocytic cells determined. The animals were then irradiated both with mild and intensive doses, and six hours following the irradiation the number of phagocytic cells was determined by the same procedure. Here also it was found that the phagocytic capacity of the reticulo-endothelial system is greatly influenced by the irradiation in that mild doses produce an increase and very intensive doses a decrease of the phagocytosis.

3. Since the above experiments could not be repeated in humans and since it was essential that the function of the reticulo-endothelial system in humans be determined by some method which would not impair otherwise the general resistance of the body, the author resorted to the Kauffmann test. This as is known consists in the determination of the degree of a local reaction provoked by application of cantharidis plaster. Since the local reaction depends on the state of the general resistance (immunization) of the organism it directly expresses the immunobiologic balance of the system at the time of examination. The procedure is as follows: A plaster 1.5 to 2.0 cm. long and of equal width is slightly warmed and applied to the skin of the leg, due care being taken that the plaster is set at each examination in the same region. Twenty-two hours later the plaster is removed and the content of the blister collected (by means of a sterile needle) in a U-tube of 2 to 3 cm. diameter, and immediately centrifuged. Following the completion of the centrifugation the U-tube is

cut on one side exactly at the level of the sediment and the cellular sediment is stirred with a needle. One drop of the sediment is placed on a microscope slide and stained according to the panoptic method of Pappenheim (with May-Grünwald and Giemsa solution). A differential count is made of 400 cells and the percentage of the non-granulated cells (the so-called lymphohistiocytic elements of Kauffmann) determined.

The investigations were carried out in women irradiated for collum carcinoma (without fever or any other inflammatory complications). It was found that the percentage of the non-granulated basophilic cells previous to irradiation was on the average 4.2 per cent and that following intensive irradiation (with four large fields at 30 cm. distance; the Kauffmann test having been carried out daily for a period of eight days) it had dropped to 1.4 per cent, while following irradiation with milder doses (nine fields, 3 mm. Al, 23 cm. skin target distance, 8 min. per field, 38 to 40 cm. spark gap) it increased to 6 per cent. This again proves that irradiation considerably influences the function of the reticulo-endothelial system resulting in a decrease of the general resistance of the body following the administration of large doses and an increase following the administration of small doses of roentgen rays.

4. The effect of the radiation reaction on the general immunobiologic balance of the body was also tested by the Freund-Kaminer method which utilizes the carcinolytic property of the organism as an index of measurement. For this purpose, first a carcinoma cell emulsion is prepared. The tumor is cut into small particles, filtered through a porous cloth, and the filtrate is treated with 0.6 per cent NaCl and 1 per cent sodium phosphate. Then, the blood of the patient is taken (on an empty stomach) and twenty drops of the hemoglobin-free serum are mixed in a glass tube 5 cm. high and 0.7 cm. wide with one drop of the cell filtrate and two drops of a 3 per cent tricresol solution. After vigorous shaking a drop of the mixture is placed in a Thoma-Zeiss chamber and the number of carcinoma cells counted for four times 16 quadrants (there being on an average 20 carcinoma cells in 16 quadrants). The rest of the mixture is placed for twenty-four hours in an incubator at 37°C. and the next day the count of the carcinoma cells is repeated. Normally there is a 55 per cent destruction of the carcinoma cells due to the carcinolytic action of the serum. Following irradiation with intensive doses, there is a 5 per cent drop while following irradiation with milder doses there is a 7 per cent increase in the carcinolytic power of the serum, both phenomena lasting for a period of from eight to ten days.

Proof is thus brought that intensive irradiation leads to a general reaction which lessens the resistance of the organism. That this must have a great influence on the carcinoma itself is beyond doubt. Of course the primary destructive effect of the roentgen rays on the tumor cells is of equally great importance and the fact that intensive radiation gives satisfactory results in many cases of carcinoma depends directly on this primary effect. However, when a carcinoma is more extensive and a more severe general reaction is produced the secondary effect, by lessening the general resistance of the body, may act unfavorably on the carcinoma.

Since it is known that irradiation of the spleen greatly increases the immunobiologic reactions of the organism, the author carried out a number of experiments in order to determine whether this property of the spleen could be used to counterbalance the unfavorable systemic reaction produced by the intensive primary irradiation of the carcinoma. By making use of the Kauffmann test and by administering 3/4 S.U.D. over the spleen, it was found that the number of non-granulated basophilic cells increased in normal individuals 7 per cent (to a total of 13.5 per cent), while in carcinoma patients the increase was as high as 8.9 per cent. The Freund-Kaminer test led to similar results. The carcinolytic power of sera of carcinoma patients increased within twenty-four hours on an average of 25.1 per cent. These latter experiments coincide nicely with those of Murphy and Nakahara who by administering mild doses of roentgen rays to mice were able to prevent the taking of grafts within the irradiated area, a phenomenon which no doubt is due to an increased phagocytic function of the reticulo-endothelial system.

The above findings are of great practical consequence. They indicate, for example, that the application of radium in collum carcinoma is of greater advantage because of the lesser general reaction and thus lesser effect on the

resistance mechanism of the body. On the other hand, irradiation of the spleen following the administration of severe roentgen treatments ought to favorably influence the general systemic resistance by counteracting the diminished function of the reticulo-endothelial system.—*T. Leucutia.*

Henrard, Etienne. Relief, pseudo-relief, triade stéréoscopique. (Relief, pseudo-relief, stereoscopic triad.) *Bull. et mém. Soc. de radiol. méd. de France*, June, 1929, *17*, 174–177.

In order to obtain a good stereoscopic impression of the object examined it is often advisable to obtain in addition to the relief also a pseudo-relief picture. The interchanging of films in the stereoscope so as to view the object in an anteroposterior and postero-anterior view (that is, in a relief and pseudo-relief) successively, necessitates a long maneuver and consequently a change in the accommodation of the eyes. Therefore, the author conceived the idea of taking three roentgenograms at the same time and viewing the roentgenograms in a small hand stereoscope simultaneously for the anteroposterior and posteroanterior view. The Belot drawer cassette provided in its midportion with a small window 8 by 8 cm. is used for this purpose. The film which is 9 by 24 cm. is placed in the drawer and moved successively in front of the window for the three exposures (the top of the cassette being covered, with the exception of the window, by 4 mm. lead so as to protect the film during the exposure). First the roentgenogram for the right eye, then that for the left eye and finally a roentgenogram similar to the first is taken. The apparatus can be used only for objects of small dimension (hand, wrist, foot, ankle, elbow, localization of foreign bodies of the eye, etc.). For the larger objects two stereoscopic roentgenograms are made by the usual procedures and these are then reduced to the size of the stereoscope, one of the roentgenograms being printed twice.

The three roentgenograms so obtained are placed side by side in the hand stereoscope (the single roentgenogram being placed in rhe middle) and the obiect viewed for the telief and pseudo-relief simultaneously.

For regions hard to distinguish it is advisable to place some landmarks on the skin for better orientation.—*T. Leucutia.*

Belot, J. Apparatus for protecting the roentgenologist when making roentgenoscopic examinations with the patient standing. *Radiol. med.*, Oct., 1929, *16*, 1017–1027.

The most dangerous of all roentgen procedures is screen examination. The author describes and illustrates a vertical roentgenoscopic apparatus which assures absolute protection for the roentgenologist, his assistants and the patient. They must be protected against accidents which might result from the use of a high tension current, against direct radiation and against secondary radiation, of which the patient is one of the chief foci. This vertical roentgenoscopy installation is made up of three parts, the first of which is a cabinet strictly reserved for the electrical generating apparatus and the roentgen-ray tube; the second is a dark room containing the screen and all the apparatus required by the roentgenologist and his assistants in making the examination; the third is a lighted corridor between the cabinet and this dark room and is reserved for the patient. The patient stands upright on a movable platform which can be moved laterallly or rotated by the roentgenologist from his post. It is not necessary for the patient to be moved up or down as these movements can be made by the tube and screen; they are connected with each other so that when one moves up or down the other does. It is also possible to diaphragm the ray for oblique examinations. There are mechanical and electric arrangements by means of which the roentgenologist can make all the necessary movements of the tube, screen and movable platform on which the patient stands; there is a pedal by means of which he can open or close the current of the generator and change the transformers if desired.—*A. G. Morgan.*

Fried, C. A new tube stand to use with a Metalix therapy tube. *Strahlentherapie*, 1929, *33*, 160–168.

A new drum-like arrangement which is suspended from the ceiling is described. It is designed for use with the Metalix therapy tube up to about 190 kv. Complete protection of the patient and the operator from high

tension and from radiation, as well as safety against omission of filter, is claimed by the author.—*O. Glasser.*

Dauvillier, A., Laborde, A., and Saget, J. Sur la réalisation de l'unité *r* internationale. (On the realization of the international r-unit.) *Bull. et mém. Soc. de radiol. méd. de France*, May, 1929, *17*, 148–150.

The International Congress of Radiology in Stockholm definitely adopted the international unit of measurement. This of course necessitates the restandardization of all measuring apparatus.

For the purpose of the standardization of the French apparatus the authors used a constant tension generator of 250 kv. functioning with autoregulation and operating an oil immersed Coolidge tube. The tension was measured by means of the sphere gap and checked against the Abraham-Villard electrostatic voltmeter. The ionization current of the standard air chamber was measured either by the electrometric (according to Moulin and Lattès) or by the galvanometric method. The first method, which is the more sensitive, permitted the interpolation of copper filters as thick as 7 mm. In connection with this, the author calls attention to the fact that when using an electrometer for the purpose of measurements the zero method is the more accurate and certainly superior to all other idiostatic methods which measure a certain amount of charge or discharge. This is because the zero method prevents any deformation of the electric field within the standard chamber, a fact which no doubt is responsible for the errors of many investigators using the electrometric method.

The standardization itself consists in the determination of absorption curves of the copper for different tensions of the radiation, both for the standard chamber and the dosimeter to be standardized. By taking account of the various factors (saturation, complete absorption of the corpuscular rays, neutralization of the secondary rays due to filter, correction of the density of air, etc.), it is possible to plot a curve for each tension and for each thickness of filter, the number of roentgen per second being expressed in the unit current (1 microampere) of the dosimeter. It was found that there is an increasing divergence of the curves with the increase in the shortness of the effective wave length.

In order to spare the practitioner the rather tedious job of determining the effective wave length in each particular instance, the standardization curves were reduced to the necessary minimum and were arranged in the form of a table. It is assumed, of course, that the generating apparatus is one of constant tension and that the filter is always copper. Under these circumstances the quality of the roentgen rays depends solely on the tension and on the thickness of the filter. By expressing the number of r corresponding to the unit current of the dosimeter for each filter in function of tension and by arranging the curves so obtained in a table an accurate interpolation for any filter thickness can be obtained. In case the tension produced by the generator is not constant, it is necessary to determine the effective wave length by the copper filtration, which is best done by means of a dosimeter. In this case the standardization curves will express fairly accurately the dosage in r-units.

Since 1 r is equivalent to 100 ergs (exactly 95.67) per 1 c.c. of water, the radiation expressed in r can be easily computed into the absolute unit of roentgen energy. The above standardization curves were determined for dosimeters with a cenon chamber but they can be applied to any other type of apparatus.—*T. Leucutia.*

Thaller, R. Progress in dosimetry of cathode rays. *Strahlentherapie*, 1929, *33*, 263–272.

According to Lenard's suggestion, the author uses as the unit of intensity of a cathode-ray beam that number of electrons which passes through one square centimeter per second, and therefore proposes that the intensity be stated in ampere-seconds. Besides the intensity, the velocity of the electrons must be given, either in per cent of the light velocity or in volt velocity. A fixed condenser of special construction is described in detail which is used for measuring cathode-ray intensity by various connections to a pointer galvanometer.—*O. Glasser.*

Neeff, Th. C. Exact dosage by the use of the Sabouraud tablet. *Strahlentherapie*, 1929, *33*, 169–180.

The author presents investigations on the dependence of readings of the Sabouraud tablets upon the radiation quality, and recommends a set of rules for the proper use of these tablets in dosimetry. In this connection various methods of determining radiation quality (half-value layer in Cu and Al, effective wave length) are discussed, and a number of curves to correlate these methods are given. In addition to dosage data in X-units for the Sabouraud tablets, doses in r-units are also given, and it is stated that for soft radiation a smaller number of r-units produces the same effect upon the human skin as for hard rays.—*O. Glasser.*

Stahel, E. Determination of the energy amounts of gamma rays and roentgen rays which are absorbed in the tissue. *Strahlentherapie*, 1929, *33*, 296–321.

By means of a specially constructed calorimeter the energy of gamma rays which is absorbed in a certain volume of a liquid is determined. Well-known dosage units are then expressed in the measured energy units. The "D" unit for gamma rays, for instance, is found to be equivalent to 38,000 erg/ccm. The average erythema dose for gamma rays, which is considered to be 18 D, consequently amounts to 700,000 erg/ccm. For local treatments with gamma rays a considerably larger dose can be applied (up to 8,000,000 erg/ccm) than for distant radiation. Various examples and data are given to illustrate these points. Another calorimeter with a liquid absorber is described for use in measuring the absorption of roentgen rays. The absorbed energy of roentgen rays, which is equivalent to a skin unit dose of 600 r-units, was found to be 96,000 erg/ccm. From these data it must be concluded that for identical absorbed energies the roentgen rays show a much stronger biological action than the gamma rays of radium.—*O. Glasser.*

Nasledow, D., and Scharawsky, P. The problem of high tension measurements. *Strahlentherapie*, 1929, *33*, 394–398.

The voltages of a valve tube machine and a mechanically rectified apparatus were determined by means of a standard sphere gap and also by registering the minimum wave length of a spectrogram taken with a Seemann spectrograph. The latter was determined by observation with an ordinary microscope. The authors claim that for a voltage range from about 86 to 144 kv. their accuracy in determination of voltage by means of the spectrometer is 1.1 per cent, and that the average difference of this voltage from the one determined with the sphere gap amounts to only 1.5 per cent.—*O. Glasser.*

Benassi, E. Roentgen irradiation and vital staining of the reticulo-endothelial cells. *Radiol. med.*, Sept., 1929, *16*, 874–891.

The reticulo-endothelial cells normally take on a vital stain when certain stains are given intravenously. The author made a systematic study to determine whether this property of vital staining is affected by irradiation with roentgen rays. He gave injections of trypan-blue to rabbits and paid special attention to the vital staining of the liver and spleen. He examined many histological specimens and compared them with control specimens from animals that were not irradiated. He found that there was no great difference between the controls and the rabbits irradiated with small doses of roentgen rays, no matter whether the irradiation was given over the spleen or over the liver. In animals given moderate dosages of irradiation there were considerable differences from the controls, particularly in animals killed twelve days after the irradiation. If the irradiation was given over the liver region the Kupffer stellate cells were much more deeply stained than in the control animals and there was a much greater number of granules scattered in the protoplasm of the liver cells. But if the splenic region was irradiated there was much deeper staining of all the reticulo-endothelial cells than in the control animals and particularly the macrophages which were seen in considerable numbers. In specimens from animals which had been given strong doses of rays the differences from the controls were less marked. In the liver, except for the fact that the cells contained larger numbers of granules, the intensity of the staining was about the same as in the control animals or even a little less in the stellate cells in certain animals. When the spleen was irradiated, in addition to evident lesions from the rays there was a larger number of macrophages than in the controls but they did not

contain as many granules and the staining was less intense.

The author discusses the different interpretations that may be given to these results and concludes that they at least show that moderate doses of roentgen rays may stimulate and increase the capacity of the reticulo-endothelial cells for taking up stains from the blood while smaller doses do not act on the cells sufficiently to cause any perceptible difference. If the dosage of rays is too high the limit of stimulation is passed and that of suspension of activity or even of destruction reached so that the staining of the cells is the same as or less than that in the control animals.—*A. G. Morgan.*

Hausmann, W., and Zakovsky, E. The effect of cathode rays on erythrocytes. *Strahlentherapie*, 1929, *33*, 196–198.

In irradiating blood agar plates with cathode rays from a large Lenard tube (70 kv., 10 mm. distance, Al window to plate) the authors find that a ring of hemolysis is produced which encloses an area of erythrocytes that becomes resistant to decay and saponin. A critical discussion of this observation is given and further experiments on the problem are promised. —*O. Glasser.*

Glocker, R. The effect of roentgen rays upon the cell as a physical problem. *Strahlentherapie*, 1929, *33*, 199–205.

After a detailed discussion of the evaluation of results of radiation studies upon biological specimens (damage curves, variation curves) the author discusses the application of his theory of the action of radiation which is based upon the experimental results obtained from irradiating *Vicia faba equina*. These results support the theory, and a number of conclusions may be drawn. The "time factor" in radiation therapy, for instance, can easily be explained by the findings; also, it is possible to determine the area of radiosensitivity within the cell. It is to be expected that the correct determination of the damage curves for a biological specimen necessitates further study, and may solve the problem of the essential effect of radiation upon the cell.—*O. Glasser.*

Liechti, A. The time factor of the biological effect of radiation. *Strahlentherapie*, 1929, *33*, 1–53.

In a masterful treatise, which should be studied in the original, the author presents his experiments on the effect of roentgen rays of various quantities and qualities, as well as of ultraviolet rays, upon Ascaris eggs, the human skin and bacteria. He comes to the conclusion, that the time factor of roentgen rays upon Ascaris eggs and upon bacteria is smaller than 1, or in other words, that the biological effect of small doses spread over a longer time is smaller than that of larger doses applied in shorter time. Also human skin and pig skin show an incomplete summation of divided doses. Ultraviolet rays, similarly, have less effect in divided doses than in stronger single doses. Further studies deal with the sensitivity of Ascaris eggs in relation to the primary damage of radiation on them, the relation of the roentgen-ray doses to those of ultraviolet rays for various stages of damage to the eggs, and finally, the dependence of the sensitivity of Ascaris eggs upon the wave length of the radiation. He finds that hard and soft rays for identical doses produce identical effects.—*O. Glasser.*

Rajewsky, B. Further investigations on the radiation effect on albumin. *Strahlentherapie*, 1929, *33*, 362–374.

Further investigations on the effect of roentgen rays upon albumin were made by studying the coagulation of the albumin by means of a specially constructed ultramicroscope motion picture camera. The latent period after irradiation before the change in the number of microscopically visible particles was especially studied. This change was recorded in various curves and the results are critically discussed. They again support the Dessauer point heat theory of radiation effects. —*O. Glasser.*

Vischia, Q. The effect of roentgen rays on the abdominal sympathetic in dogs after removal of one suprarenal gland. *Radiol. med.*, Oct., 1929, *16*, 1038–1063.

The author discusses the relations between the vegetative nervous system and the endocrine glands from the point of view of physiology and embryology. He says that these two systems are really component parts of a single system and that the theory of the priority of the endocrine lesions is no longer tenable.

He says that the changes are reversible, which argues in favor of his theory, and discusses syndromes which develop primarily in the glands (primary, endocrine syndromes), those due to sympathetic changes (avitaminoses) and other syndromes to which he gives the name of endocrino-sympathoses.

In the course of his investigations he studied the effect on the blood picture of irradiation of the abdominal sympathetic, more particularly Luschka's celiac region, after extirpation of the suprarenal gland. He finds that irradiation of the celiac region brings about an increase in the number of cells. In the leucocytes there is neutrophile polynucleosis and lymphopenia. A few days after the irradiation there is lymphocytosis with decrease of polynuclears while from the fiftieth to the sixtieth day after the irradiation there is a return to the neutrophilia and lymphopenia with a tendency to increase of the transition forms. There are few changes in the irritative and regenerative forms which can be seen both after removal of the suprarenal capsule and after irradiation. According to the author these changes in the blood picture, which were seen quite a long time after the irradiation, were not due solely to the irradiation but rather to the removal of the capsule, with perhaps some effect from the irradiation.—*A. G. Morgan.*

Roffo, A. H., and Degiorgi, H. Changes in blood cholesterin in vitro. *Strahlentherapie*, 1929, *33*, 385–388.

In 1925 the authors reported the destruction of cholesterin in vitro by roentgen rays in solutions containing chloroform. The change in the cholesterin seems to be brought about by an oxidation which acts on the molecule and at the same time has an acid action. Hieger of the London Cancer Institute confirmed these results and found that cholesterin is affected by roentgen rays only in solutions that contain chlorin.

The composition of the medium seems to play a part in the process. In order to test this point more carefully the authors repeated their experiments in blood serum which is a colloidal medium. A table of the details is given. It shows that irradiation of blood serum in vitro destroys cholesterin in some cases up to 67 per cent; that the intensity of the destruction depends on the time of irradiation and that the destruction is greater the less the cholesterin content. There is very little difference in the surface tension of the serum before and after irradiation, which the authors ascribe to physico-chemical properties of the body formed from the cholesterin. They have not been able to prove this because the solvents of cholesterin have a low surface tension and do not change their surface tension much when cholesterin is added. These results agree with their findings in organic solvents. But as these examinations were made in so complicated a medium as blood serum it was not possible to ascribe the oxidative process to solvents of definite atomic composition as bodies of different chemical composition and in different conditions were present in it.—*A. G. Morgan.*